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ABSTRACT

This material is one publication of a series of documents available from the Institute for Environmental Education (Cleveland) and consists of a curriculum activities guide to birds, bugs, dogs, and weather and environmental studies. The first edition of this material was prepared by the Documentation Task Force of Project KARE, Philadelphia, and was revised by personnel at the institute. The guide is intended for use by teachers and students until they feel sufficiently confident to prepare their own materials and is organized into three sections: Chapter 1 is on awareness activities, 2 on transitional activities, and 3 on operational activities. Awareness activities, developed with process skills in mind, are designed to orient students toward a concern for environmental problems and a realization that the problems are appropriate subjects for study. Transitional activities are directed toward real community concerns. Operational activities are integrated with community efforts to solve environmental problems. The guide's format is that of a questioning sequence, using questions to (1) lead to the activity, (2) initiate the activity, (3) continue the activity, (4) expand the activity, and (5) evaluate the activity. Teachers using the guide are invited to use only those activities that are most appropriate to their situation. (PEB)

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A Curriculum Activities Guide to

BIRDS, BUGS, DOGS & WEATHER

and

ENVIRONMENTAL STUDIES

SE 017 108

VOLUME FIVE

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A CURRICULUM ACTIVITIES GUIDE TO BIRDS, BUGS, DOGS, AND WEATHER

AND

ENVIRONMENTAL STUDIES

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PREFACE

This publication is one in a series of documents designed to guide others in initiating, continuing, or expanding their environmental education program.

Volume V was prepared in the evolution of a plan which began with an environmental studies course for students in Cleveland, Ohio in 1967 and 1968. The course became a training program for teachers and students at Tilton, New Hampshire, in the summers of 1969 and 1970, at Quincy, Massachusetts and Newtown, Pennsylvania, and again in Cleveland in 1971, and finally the full-time responsibility for the Institute for Environmental Education in 1972.

That plan coincided with another. John Trott, a gifted teacher at Burgundy Farm Country Day School, Alexandria, Virginia, began a summer camp at Cooper's Cove, West Virginia, teaching young people how to analyze and appreciate land, plants, and animals and their relationships. These studies, however, had never been recorded and replicated for public dissemination and so the Office of Environmental Education awarded grants to both groups to join forces in an attempt to expand the form and content of the Environmental Education Guide Series.

The teachers, students, and administrators who taught, directed and then wrote these results of their experiences have increased in numbers and sophistication. They now occupy positions of responsibility in education and governmental institutions throughout the country. Two of these, Jack Hershey and Al Sexton, who were at Tilton, Quincy, and Cleveland, and who organized Volumes I and II in the Guide Series, at the time of this work

were Environmental Specialists at Project KARE. Thus - the links among the Institute for Environmental Education, Burgundy Farm Country Day School Wildlife Camp, and Project KARE were formed.

This Volume, and these people are some of the forces behind the new, exciting, promising, and certainly pervasive national environmental education movement.

ACKNOWLEDGEMENTS

We would like to express our gratitude to the people who were instrumental in bringing together the energies of Burgundy Farm Country Day School Wildlife Camp, the Institute for Environmental Education, and the Documentation Task Force of Project KARE.

A few of these are: David Rosenthal, Crane Miller, John Trott, Win Coffin and Jim Shiflett from the Board of Trustees, faculty and alumni of Burgundy Farm Country Day School. Others are: Jack Baker, Jack Ingersoll and Rowland McKinley of University School; George Watkins, Three Rivers Watershed District; Peter Mott, Moses Brown School; Alan McGowan, Center for the Biology of Natural Systems and Scientists Institute for Public Information; Tony Governanti, Bob Graham and Phil Murphy of Tilton School; Ned Ames and Bill Felling of the Ford Foundation; Kay Bela, Bernie Lukco, and Robert Snider of the Environmental Protection Agency; Walter Bogan and George Lowe of the Office of Environmental Education (HEW); Ray Whitehead of Quincy Public Schools; Peter Gail and Tom Offutt of the Institute for Environmental Education.

This Guide was organized and edited by the team of John Hershey and Alan Sexton (two of the four staff who edited Volumes I and II) and Patricia Sparks. They compiled contributions from programs in Cleveland, conducted by the Institute, Cooper's Cove, conducted by the Wildlife Camp, and in Philadelphia, conducted by members of Project KARE. The staff writers were Peter Goldie, David Kriebel, Robert Lippincott, Jerry Ruddle, Jim Shiflett, Ronald Spencer, Tim Tanaka, and Melissa Weiksnar.

The efforts of Bette Connelly, Sue Faulkner, Diana Geist, and Claire Pilzer made the writers' imperfections tolerable to the Documentation Task Force staff. And, at the Institute, Sally Gardner retyped a second edition which differs from the first in the selection and combination of activities included. Some of the activities here were prepared by the Task Force for another publication, but for reasons given in the Introduction, they were felt to be more appropriate in Volume V.

Special thanks go to Donald L. Wright, Director of Project KARE who encouraged the effort to formulate the Documentation Task Force (DTF) in conjunction with the Institute for Environmental Education, and Alan C. Harman, Executive Director of Montgomery County Intermediate Unit #23, who facilitated the DTF effort in a myriad of ways from board approval to accounting procedures. The cooperation of the Intermediate Units of Bucks, Chester, Delaware, and Philadelphia Counties and the Roman Catholic Archdiocese of Philadelphia is likewise appreicated.

Since the DTF began, there have been several personnel changes. Matthew M. Hickey has succeeded Donald L. Wright as Director of Project KARE. Alan D. Sexton has succeeded Mr. Hickey as the Assistant Director of Project KARE, John T. Hershey became Manager of Environmental Programs for the University City Science Center, Philadelphia, Pennsylvania. Mr. Hickey and Mr. Sexton are currently administering the DTF from which will come further edited materials disseminated by the Institute for Environmental Education.

Joseph H. Chadbourne
President
Institute for Environmental
Education

INTRODUCTION

We find that there is no distinct set of records which can be used to define or become "environmental education". That is because environmental education is a general process which is applied to special problems. This book contains illustration of the process applied to four problems; birds, bugs, dogs, and weather.

The general definition of environmental education is treated in the 1970 Environmental Education Act Guidelines, available from the U. S. Office of Environmental Education (HEW) and is analyzed as a learning theory by William Stapp in "Development, Implementation, and Evaluation of Environmental Education Programs (K-12)", also available from the Office.

Our special definition of environmental education, derived from attempting to implement the 1970 Act, and coined by one of the Institute staff, Thomas W. Offutt III, is that environmental education is "precareer experience". It is experience in the process of attempting to understand and cope with present problems, in order to prepare to understand and cope with future problems. The "problems" are the problems of society. They are chosen for study by those to whom the problems make a difference.

In this sense, environmental education, or precareer experience, is for everyone, of all ages, in all disciplines, and in every community.

The benefits to the persons involved in environmental studies are that they learn a common process from studying unique problems. The skills and knowledge specific to both are applicable in school and community. In addition students invariably become more self-directed in the acquisition of new learning tools, they demonstrate more understanding toward teachers, they become

more engrossed in the functioning of society, and they are clearly more aware of their increasing competence in shaping that society.

The entire Environmental Education Guide Series (see inside front cover) publication series is literally a guide to assist administrators, teachers, and students to initiate, continue, or expand this meaning of environmental education. This Volume is intended for use by cadre who have used similar materials at a training workshop. It is simply a crutch until the teacher and his students feel sufficiently confident to prepare their own materials.

Volume V is organized in three sections: Chapter I on awareness activities, Chapter II on transitional activities, and Chapter III on operational activities. These are the three phases through which teachers and students seem to progress enroute to an environmental education program.

"Awareness" activities are designed to orient students toward a concern for environmental problems and a realization that the problems are appropriate subjects for study. These activities have been developed with process skills in mind. The skills include (a) observing, (b) categorizing, (c) comparing, (d) measuring. They are foundation for transitional activities in which students take a larger share in determining the study problem.

"Transitional" activities are directed toward real community concerns. Students begin the activity in the community, observing the nature and scope of the concern, determining available resources, assessing the level of community cooperation, and calculating their potential role in understanding and attempting to cope with the concern. The necessary tools include all of the disciplines, the rigors of investigation encourage professional behavior, and the complexity of problems reveals one of Barry Commoner's conclusions that "everything is connected to everything else".

"Operational" activities are integrated with community efforts to solve environmental problems. The assumption is that the students have qualified to perform the work, the work is important, and it cannot otherwise be purchased or performed. The community turns to the school environmental group for assistance. What we mean is stated clearly in a letter on page from George M. Jonkel of the Department of the Interior to one of the authors.

This Volume illustrates the process in four problem areas. The process begins with awareness, then moves to transitional, and reaches the fully operational level. The four problem areas are not developed in each of the three phases. In summary, this Volume is organized to include the following process:problem sections:

	Problems			
	Birds	Bugs	Dogs	Weather
Process				
Awareness	X	X	X	
Transitional	X		X	
Operational	X			X

The Guide format is a questioning sequence. The progression is (a) those questions that lead to the activity, (b) those that initiate the activity, (c) those that continue the activity, (d) those that expand the activity, and (e) those that can be used to evaluate the activity. The distinctions from step to step are sometimes unclear, perhaps too fine, possibly not necessary. Since it is not the format that is important but the results, then - by all means - modify it.

Though there is an order to the questioning sequence, there is not an order to the activity sequence. Select the ones that are the most appropriate.

Ordinarily, "operational activities" are prepared as Case Histories in the Environmental Education Guide Series F because they are usually too long and too specialized. Indeed, that is the situation with the operational activities on birds and weather here. Our justification is that we also had awareness and transitional activities for birds, because of the association with Burgundy Farm Wildlife Camp, and also because weather factors are an intimate component of the Wildlife Camp's regular studies. They can be used, however, as examples to discuss with administrators, parents, and colleagues to represent your program. These two also contain many useful procedures. And, finally, they stand as an exciting chronicle of the positive, creative, constructive things that young people are doing.

Others can learn from your discoveries. With your permission, we would be pleased to serve as a disseminator. (The Institute has applied to the Office of Environmental Education (HEW) for a limited copyright to facilitate continued productivity and dissemination of the series.) Your purchase dollars have helped keep this work going. We hope you parted with them happily.

Good luck,

Staff of Project KARE, Burgundy
Farm Wildlife Camp, and the
Institute for Environmental
Education

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Note. We want to be absolutely clear that only one person is "credited" with these titles - Jack Hershey.

CHAPTER I

Chapter I contains "Awareness Activities" on birds, bugs, and dogs. Preceeding these is one activity on statistics, simply to suggest the kinds of related classroom studies that can be used when they are requested by the students.

One or all of these plus other activities could be conducted by one class at one time by assigning groups according to their interests. For example, one group might also begin to construct weather measuring devices. Some instructions for building these devices are contained in Volume III of the Environmental Education Guide Series E, see inside front cover, but any biology or earth science course has these references.

They are designed to initiate "awareness" of the environment and also to initiate "awareness" that an infinite number of such activities are appropriately studied outside the classroom and should be undertaken. Procedures can be developed by the students as part of the whole program.

If the students are beyond this stage, simply turn to Chapter II.

Section 1

Population Sampling

I. Introduction

This activity enables upper elementary students to gain some understanding of the nature of statistics, as a result of taking random samples of a "population". In this classroom activity, the student is exposed to work with data tables, proportions, and an idea of the varying degree of validity found in statistics.

II. Questions

1. Questions which lead to activity:

   a. What is chance?

   b. Can you predict the outcome of an event that is dependent upon chance?

2. Questions which initiate the activity:

   a. How can we figure out how many beans are in the box for each pea--or vice versa? Is there any other way besides counting all of them?

3. Questions which continue the activity:

   a. Are there more peas or beans in the mix? (following step 2 of procedure)

   b. Why do you say there are more beans?

   c. Which of the five statements would most likely fit four pieces taken from the box with your eyes closed?

   d. Concerning procedural step 8, ask: Is the number of beans for each pea the same when only 5 were picked as when 60 were picked? Is there a difference between them? Explain.

How do the ratios compare with the 3 beans for each pea that we counted before?

e. What difference is there in counting beans and peas in a box and in counting rabbits and squirrels in a woods? What problems would we have in trying to count the number of rabbits or squirrels in a woods?

4. Evaluate the students efforts by asking:

a. Did this activity interest the students?

b. Did they wish to extend the study in any way?

III. 1. One bag of lentil beans and one bag of dried peas

2. A shoe box or other suitable container

3. Blank data charts (if before-class preparation of charts is desired)

IV. Procedure

1. In a shoe box, mix in a 3 to 1 ratio a total of at least 1000 pieces of lentil bean and dried pea, respectively.

2. Have each child take a small handful of the mixture. Question.

3. Ask students to group in fours and separate their mix into one row of beans and one row of peas.

4. Put the five possible combinations of a random four piece sampling on the board while students work: 3 beans to 1 pea, 2 beans to 2 peas, 1 bean to 3 peas, 4 beans to 0 peas, 0 beans to 4 peas.

5. After questioning, continue by having students replace their beans and peas in the box, mix well, and have each student pick four pieces from the box with his eyes closed.

6. Beside each combination on the board, record the number of students that picked that particular combination from the box. Note to the class which combination has the highest frequency, and whether it is the combination that was most expected to occur.

7. Divide the entire box of mix among the class and make an actual count of peas and beans. Have them calculate the number of beans per pea by dividing the number of beans by the number of peas. They should find approximately the original 3 beans to 1 pea. This activity may be continued to illustrate that the accuracy of conclusions made on the basis of random sampling increases with an increase in the number of random samplings made.

8. Have students keep a data chart similar to the one following:

Total Pieces	2	5	10	50	100	150	200	250	etc.
Beans/Peas									

This is done by randomly picking first a total of 2, then 5, then 10, etc., pieces from the 3 to 1 mixture and recording the total number of beans and peas picked to that point for each picking. As a result of the questions concerning this part of the activity, the students should be able to grasp that the ratio of beans to peas is usually closer to the actual count of 3 to 1 when a larger numbered sample is taken.

V. Past Studies

Students seem to be quite interested in this activity. A sidelight to the activity, branching from a limitation is to use different sized peas

and beans and to see how this size difference affects mixing and random sampling. Students should find that size difference between bean and pea hinders the accuracy of a small numbered random sample because of the tendency to pick up the larger of the two. However, students should also find that size difference becomes unimportant as the size of the sample becomes very large.

VI. Limitations

The main limitation in this exercise is due to time and tedium. Time limits the number of random samples that may be taken in class; however, students may wish to continue the activity the following day. Preparing a mix of any more than 1000 peas or beans becomes quite laborious, therefore, students may help in preparation of the mix by counting 25 to 50 bean lots. Uniform sized beans and peas are recommended because a difference in their sizes makes absolute "random" sampling difficult. If the mix is to be shaken, care should be taken to see that the lid of the container is on tightly so that beans and peas aren't scattered all across the room.

VII. Bibliography

Button Bags, Environmental Science Center, Golden Valley, Minn. In this upper elementary curriculum materials guide, students work with proportions, graphing, estimation, and random sampling.

Freund, John E., Modern Elementary Statistics, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1960. This text acquaints students with theoretical aspects of statistics. Recommended for high school students.

Huff, Darrell, How to Lie With Statistics, W. W. Norton and Company, 1954. It is written in a humorous style and can be understood by high school students. Available in paperback.

Reichman, W. J., Use and Abuse of Statistics, Oxford University Press, New York, 1962. A general work on statistics designed for the high school student which covers the calculation of statistics and their use and abuse.

Section 2, A

Info Inflo

I. Introduction

The purpose of this activity is to learn how to collect scientific data which can be used in evaluating the activity at a bird feeding station. This is an awareness activity, as most other activities in this section assume an ability to collect and evaluate data. Therefore, this activity might be useable by any grade. Class time is needed to prepare data sheets and to evaluate data. The activity assumes the establishment of a bird feeding station; otherwise there are no specific equipment requirements.

II. Questions

1. To lead into the activity ask:
   a. What happens at a feeding station?
   b. What is the meaning of the word "data"?
   c. Is data helpful?
2. To initiate the activity ask:
   a. What is affecting a feeding station and the activity at it as you look at it?
   b. Which of these criteria change (variables)?
   c. What is the best way to arrange this information on a data sheet?
3. To continue the activity ask:
   a. Who will collect data?
   b. When will it be collected?
   c. Is everything on your data form valid?
   d. What additions/deletions should be made?
4. To expand the activity ask:

a. How does the data change over a period of time?

b. To what activities can this data be put to use?

5. To evaluate the activity ask:

a. Was data collected consistently?

b. Were variations or new discoveries emphasized?

c. Did the students become more proficient at data collection?

III. Equipment

1. Place to make frequent observations, e.g., feeding station, which is accessible by the students
2. Data sheets
3. Pencils
4. Weather equipment if deemed necessary, e.g., thermometer, barometer, anemometer, rain gauge
5. Watch or clock

IV. Procedure

1. Make data sheets. A sample follows (see next page).
2. Decide who will observe and when.
3. Evaluate the data periodically.
4. Use the data in other activities. Unused data is a waste!

Sample Data Sheet for Feeding Station

Date _____

Observer(s) _____

Time observed____:____ to ____:____

Weather conditions:

Temperature _____

Barometric Pressure _____rising ___ falling ___

Wind speed _____mph Direction _____

Cloud Cover _____

Precipitation _____

Species at Feeding Station:

No.	Species	Feeder
___	_____	_____
___	_____	_____
___	_____	_____
___	_____	_____
___	_____	_____
___	_____	_____
___	_____	_____
___	_____	_____
___	_____	_____
___	_____	_____

Species in feeding area, but not on feeders:

___	_____	_____
___	_____	_____
___	_____	_____
___	_____	_____
___	_____	_____
___	_____	_____
___	_____	_____

Comments:

V. Past Studies

1. Consistent data collection has often provided information for projects that were not anticipated. It is also the key to any long range project.

2. Perhaps it can be arranged that a weather station and the feeding station be located in close proximity. A commensal relationship might be established between the groups responsible for each.

3. Juniors and seniors at Nottingham Academy in Buffalo, New York were assigned in September to conduct a year-round study of a basic community by collecting data at least every day. Enthusiasm waned after the first two weeks. It is recommended that if data is collected over a long period of time that periodic checks be made so developments can be shared and the activity and its purpose not forgotten.

VI. Limitations

If the feeding station is not located in a convenient place where students can readily reach to get data, the activity may have to be modified to collecting a certain kind of data which is related to bird activities.

VII. Bibliography

Institute for Environmental Education, Guide Series, E, Vol. 5, A Curriculum Activities Guide to Building Equipment for Water Pollution and Environmental Studies. Contains instructions for building some weather measuring devices.

McElroy, Thomas P., Jr., The New Handbook of Attracting Birds, Alfred A. Knopf, Inc., 1960. This book is "ecological" in orientation. Simple yet thorough ways are presented of attracting birds through feeding, watering, planting, and housing. Also care of young and

wounded birds and predators would carry the interest of grades six and up. Birds and the law, and sanctuaries are also discussed.

Peterson, Roger Tory, and the Editors of Life, The Birds, Time, Inc., New York, N. Y., 1963. Suitable for grades five and up; chapters cover evolution, flight, feeding, populations, migration, communication, growth and ecological relationships. Photography excellent. Very readable.

Pettit, Mary P., My Hobby is Bird Watching, Hart Book Co., New York, New York, 1955. Simply presented introductory book to bird watching grades 3 and up could handle. Many references - books, addresses, places - are included. Gives directions for the construction and use of a bird blind.

Weeks, T. A., Teacher Tip, New Bird Ranges and Environment, State of New York, 1970. This article follows a center spread article by Walton B. Sabson on New Bird Ranges and Environment. It suggests activities and includes a bibliography. Not suitable for class use.

Section 2, B

The Family Game

I. Introduction

The purpose of this activity is to introduce students to the concept of families among birds. In this relatively uncomplicated activity students isolate various bird characteristics and attempt to classify birds using their data. However, the identification goes only to the level of family since recognition of families is the key to bird identification. This makes the activity suitable for beginners to bird activities. No prerequisite activities are necessary. The activity consists of at least one class period for making data sheets, one for observations, and one for actually classifying data. Students of any grade can participate in this activity although it may need simplification for younger (under grade five) students. Field observation aids may be needed. The activity can take place either at an established feeding station or in a more "natural" setting. By being familiar with families, students are able to narrow their choices in a field guide to only a few birds and are thus able to find species with greater ease.

II. Questions

1. To lead into the activity ask:
   a. Why bother to group birds?
   b. What is the meaning of "families" of birds as used in field guides and other bird books?
   c. What are some of the criteria for placing birds together in families?
   d. Are most of the criteria observable? Can you place a bird by sight instead of undertaking laboratory analyses?

2. To initiate the activity ask:

   a. What color(s) is the bird?

   b. What "field marks" does it have?

      1. What is its size as compared to a standard object?

      2. Is its shape chunky or slender?

      3. Do its wings have pointed or rounded tips?

      4. Are its legs proportionately long or short?

      5. Is its bill long or short?

      6. Is its bill thick or thin?

      7. Does it have a crest or top knot?

      8. Is its tail long or short?

      9. Is its tail forked, notched, square tipped, round tipped, or pointed?

      10. Is its breast unmarked, spotted, streaked or striped?

      11. Does the tail have any marks, e.g., bands, spots, or definite side colors different from the rest of the tail?

      12. Does it have a rump patch?

      13. Do the wings have bars of color or are they solid colored?

      14. Do they have any special eye marking, e.g., stripes over or a ring around them? Does the crown have a stripe, or does the the crown have a patch?

   c. What is the activity?

      1. What is the tail position?

      2. Is it cocked up or down, or is it wagging?

      3. As it climbs trees, does it proceed spirally or head first?

      4. Does it feed on the ground?

      5. On the ground, does it walk or hop?

6. Does it rummage through any debris?

d. Does it fly?

1. Does it fly in a straight or up and down line?

2. How rapidly do the wings beat?

3. Does it fly in a flock?

e. Is it a water bird?

1. Does it swim?

2. Does it do a straight or dabbling dive?

3. How does it "take off"?

4. Does it wade?

5. Does it probe?

6. What are its motions?

7. Does the tail exhibit light patches, stripes, a solid color, or black tips?

3. To continue the activity ask:

a. What is its voice like?

b. Where is the bird found?

c. When is it found?

d. What ecological niche does it occupy?

e. What else need we know to place it in a family?

f. Do you agree that some of the birds which have been placed together in the same family should have been?

g. Should some birds of different families be placed together?

h. What were the most helpful and least helpful data collected?

4. To expand the activity ask:

a. What other grouping criteria are there that are not readily observable?

b. How closely do species of some families resemble those in others

in appearance and habitats?

c. An ambitious student may wish to construct a dichotemous key based upon the species observed.

5. To evaluate the activity ask:

a. Did the students make thorough observations?

b. Were they "turned on" by the activity?

c. How accurate was their placing of birds in families from this data?

d. Are they able to recognize families by pointing out characteristics?

III. Equipment

1. Data sheets
2. Pencil
3. Binoculars
4. Bird blind if necessary
5. Camera
6. Tape recorder
7. Plenty of field guides and identification books
8. Place to observe birds - either established feeding station or other place where different species are attracted.

IV. Procedure

1. Using the questions, arrive at a uniform means of collecting data - e.g., a data sheet.
2. Arrange the data collection method - e.g., one group may be responsible for certain characteristics.
3. Take data. Include drawings, photos, sound recordings.
4. Group birds in families based on data selected.

V. Limitations

1. Unless a wide variety of birds is observed, there is not much point

in conducting the activity. Choose a place for observation where it is almost "guaranteed" that birds will be found.

2. It may be inconvenient to have a large group of students observing the same birds from the same place. Dividing the students into teams is advised.

VII. Bibliography

Booth, Ernest S., Birds of the East, College Press, Keene, Texas, 1962. Book is designed as a field guide, ages 10-85, to bird identification. Dichotomous keys accompany the orders and families of birds. Birds are then identified by description, nest, voice, and distribution. A forty-eight page color centerfold of birds appears. The appendix covers eggs and nests, photography, feeding tables and nesting boxes, banding, and bird references of all types. The dry manner of presentation might best appeal to grades seven and up.

Cruckshank, Allan, A Pocket Guide to Birds, Dodd, Mead and Co., New York, New York, 1952. Paper back approaching identification through the recognition of family groups, useable by the beginner. There are 72 color photos and 78 drawings. A field guide, it includes birds of Eastern and Central North America.

Griscom, Ludlow, Audubon's Birds of America, The Macmillan Co., 1950. A full page is devoted to each of 288 different birds of North America. A brief caption includes a general idea of the birds preferred habitat or type of country where it is found, and where it is found in the United States. Also, popularity, length, wingspread, and/or any noteworthy characteristics are included. Grades 3 and up could find it helpful.

Peterson, Roger Tory, A Field Guide to the Birds, Houghton Mifflin, Boston, Massachusetts, 1947. Small print perhaps unsuitable for

students younger than grade nine. Obviously not for the beginner. Field marks, voice, range, and similar species are listed for each type bird. 1,000 illustrations, 500 in full color, adorn "the standard book for field identification".

...How to Know the Birds, An Introduction to Bird Recognition, Riverside Press, Cambridge, Mass., 1962. Readable introduction to bird watching and identification. Simple manner of presentation suitable for grades five and up. After a section on what to look for, typical members of 54 families are noted with an informal caption. Over 200 species are illustrated either in 400 drawings or on 24 color plates. There is a section on habitats, and also on silhouettes of common birds, perhaps the book's most distinctive feature.

Zim, Herbert S., and Gabrielson, Ira N., Birds, Golden Press, New York, New York, 1963. Very readable guide, suitable for grades 3 and up. The print is large, there are 129 color plates of birds, and maps of the continental U.S.A. accompanying each bird which have shaded the range in both summer and winter. Size and characteristics are given. An introduction, including equipment, observation, clues, and identification guidelines are given. The book is designed for use in the field.

Section 2, B

Operation H.A.B.I.T.A.T.S.

(Helping Attract Birds In To Artificial Temporary Settlements)

I. Introduction

Operation H.A.B.I.T.A.T.S. actively involves students in the design, construction and maintenance of bird feeders. It qualifies as an awareness activity, because students must consider a wide range of criteria, covered in the following questions, before they can responsibly alter their environment by adding to it to affect the local bird population. However, although the construction may be a one-day activity, the students must assume the responsibility for the feeder. Bird feeders can be of a very simple construction, but in many cases special equipment and materials must be scrounged. Kindergarteners can make and enjoy simple feeders; older students can come up with challenging designs which makes the activity not-so-elementary.

II. Questions

1. To lead into the activity ask:
   a. Have you ever fed birds before?
   b. What did you feed them?
   c. Where did you feed them?
   d. Why did you feed them?
   e. What kinds of birds are in this area at this time of year?
   f. What is their source of nourishment?
   g. How often do they feed?
2. To initiate the activity ask:
   a. Would the establishment of bird feeders have a helpful or

harmful effect?

b. For what kind of bird(s) should the feeder be designed?

c. What is the best design?

d. What is the best location for the feeder?

3. To continue the activity ask:

a. What kind of feed should be provided?

b. How much will be needed?

c. How often will replenishment be necessary?

d. Will this be the birds' only source of food?

4. To expand the activity ask:

a. Who will assume responsibility for continuing the feeder?

b. What would the consequences be if maintenance of the feeder was suddenly suspended?

c. Has anyone else in the area had experience with bird feeders?

d. Can they be of information to us?

e. What provisions will be necessary to accommodate seasonal change?

f. Will animals (e.g., squirrels) interfere?

g. Was any type of a feeder or food preferred?

5. To evaluate the activity ask:

a. How efficient was the design of the feeders?

b. How efficient was the construction of the feeders?

c. How well are the feeders maintained?

III. Equipment

Equipment needs are as varied as the feeders. Usage of scraps should be encouraged for economical as well as ecological reasons.

1. Construction materials

a. Milk cartons

b. String or wire

c. Lumber (boards and dowelling)

d. Screws, nails, nuts, bolts, etc.

e. Tin cans

f. Cups of various types, shapes and sizes

g. Pine cones

h. Screening

i. Glass plates

j. Aluminum pan

2. Equipment

a. Saws

b. Drills

c. Hammer

d. Scissors

e. Screwdrivers

3. Feed

a. Suet

b. Various grains

c. Nuts or nut butters

d. Fruits - dried and fresh

e. Breads

IV. Procedure

1. Arrive at criteria using the questions to determine the feeders to be constructed.

2. Divide labor.

3. Design.

4. Construct

5. Maintain.

V. Past Studies

1. The time of the average school year coincides with a convenient timing consideration of bird feeders. The feeders can be introduced in the fall when the supplementary food usually is not appreciated to get the birds familiar with the feeder before winter. As spring comes, the use of the feeder can be tapered before summer, when there is no need for a supplementary food source, and students are not present.

2. Often migratory birds make appearances at feeders - a chance to see varieties not normally encountered.

3. The following six ideas for bird feeders have come from the Burgundy Wildlife Camp after repeated summers of observation:

   a. The hanging feeder is a must for any area. It should have a top to protect it from rain and snow and may have a piece of wood connecting the top and bottom, with holes for suet or other foods. It should also have a small border around the bottom to keep the seed from rolling off.

   b. The pole feeder is effective for an area where there are no trees to hang a feeder from, but you want to attract the birds that don't feed on the ground.

   c. A suet feeder that is nailed to the side of a tree or hung from a branch or wire may attract woodpeckers and other birds which are not attracted to seeds. Hardware cloth or grape bags are good for making them.

   d. A "self filling" feeder can be hung or put on a pole. With

glass on the sides, as walls, the feeder can be filled with seeds for a long period of time and the observer can see when the seed is low. As the birds eat the seeds, more fall into the platform.

e. A window feeder is attached to the window ledge. It can be filled from inside and is excellent for close observation. It can be a simple platform or have a roof for more protection.

f. The simplest way to feed birds is just to spread the feed on the ground. This is not really being lazy. Some birds prefer feeding on the ground.

VI. Limitations

1. It is extremely important not to neglect the feeders after they are established. When birds have begun to depend on the feeders for food, bad weather and an empty feeding station can be disasterous.

2. Ground feeding may be a tried method. However, continued placement of food in the same place should be avoided since a large number of birds on the ground may also deposit wastes carrying disease, contaminating food and spreading disease.

VII. Bibliography

Barton, Roger, How To Watch Birds, A. H. Yates Publishers, Inc., Rockefeller Center, New York, New York, 1961. Probably the best introductory book to all bird activities. Informally written it is suitable for grades five and up. Much is devoted to field techniques, as well as general information which is simple but helpful. Attracting, feeding, and photography are also included. Excellent - a must for any bird work.

Krutch, Joseph Wood, and Erickson, Paul S., A Treasury of Birdlore, Doubleday, Garden City, New York, 1962. Contains literary pieces regarding flight, family patterns, birds of a feather, birds and man, and extinction and conservation. Essays are short and interesting. Grades seven onwards.

Schutz, Walter E., Bird Watching, Housing and Feeding, Brice Publishing Co., Milwaukee, Wisconsin, 1963. Grades nine and up might best make use of this book which is largely concerned with construction of water and food and shelter sources for birds. There is an introduction to bird watching, and a section of foods which can be prepared.

Terres, John K., Songbirds in Your Garden, Crowell, New York, 1968. Suitable for grades five and up. Attracting and feeding birds is the main emphasis. It is written informally in the first person. References regarding foods and plants to attract birds is excellent.

Section 3, A

Coathanger Plot

I. Introduction

This activity is suggested for grade four students and up. Discussion, questions and complexity of classification can become quite involved if a high school level application is made. The activity lasts a few hours and promotes student awareness of the diversity of small animals, plants, and insects that thrive in almost every corner and niche of the earth's open surface.

II. Questions

1. To lead into the activity ask:
   a. How many bugs or beasts would you say are in one square foot of surface ground?
   b. How many kinds of plants?
   c. What is an organism?
2. To initiate the activity ask:
   a. Do you think you can find any organisms within a coathanger plot?
   b. If so, how many kinds of organisms?
3. To continue the activity ask:
   a. What kinds of beasts can you find?
   b. What difficulties do you have in finding these beasts? Why?
   c. What difficulty do you have in watching, catching and observing these bugs? Why?
   d. What qualities of your plot allow this beast to predominate?
   e. What kinds of plants can you find?
   f. Is there any one plant or kind of plant that predominates in the plot?

g. If so, why?

h. What kinds of rocks and pebbles do you find in the plot?

i. Why are they different shapes? What made them the shape that they are?

j. Did man have any part in making the rocks the way they are?

k. If you had more or less organisms in your plot than the class average, why did you?

l. Of the entire class, what team had the most organisms in their plot?

m. What was different about their plot?

n. Did you find more than one method of classifying and making distinctions between organisms?

5. To evaluate the students' efforts ask:

a. Did the examiners and recorders cooperate?

b. Did they encounter constructive arguments concerning their method of classification and distinction between organisms?

c. Did students incorrectly assume that there is only one way of classifying what they found?

d. Did students wish to continue the activity in any way?

III. Equipment

1. Coathangers (pulled out into a circular shape)
2. String
3. Toothpicks
4. Rulers to measure base and height of coathanger
5. Baby food jars if desired
6. Poster paper for diversity charts
7. Sticks or stirring rods to poke around with

IV. Procedure

1. Group the students into pairs.
2. Give each pair of students a coathanger, or toothpicks and string to make their boundary. Toothpicks can be placed in the ground at corners of the coathanger and string placed around the toothpicks. The coathanger can then be passed on to the next pair.
3. Have students partition the plot with more string, dividing it into about 4 parts. This facilitates counting and examination.
4. One student of the pair should act as examiner, using a stirring rod or stick to poke around and examine the plot.
5. The other student of the pair should act as the recorder, keeping a record of all of the different beasts, plants, and rocks that are found. The number of each type should be recorded as well as the number and descriptions of the different types found. To do this, the recorder should keep a data chart listing what and how many are found. The chart could contain the following basic headings:

Beasts	Plants
Flying bugs	Grasslike plants
Wormlike beasts	Flowering type
8 legged bugs	Weedlike plants
Hopping beasts	Mosslike plants

Rocks (categorize by:)

Color
Size
Shape
Hardness (consistency-make up)

6. It may be desirable to take samples of the findings back to the classroom for further observation. Baby food jars are handy for this purpose.

7. Have students determine the area of ground that they examined, defined by the coathanger: $A = r^2$.
8. Have each group then determine the number of living organisms found within that area.
9. Then determine the number of kinds of organisms per plot.
10. Class should then determine the average number of living organisms per coathanger plot.
11. Also, determine the average number of kinds of organisms found per plot.

V. Past Studies

Kids are amazed at the number of organisms-plant and animal-that they find in the plots. They are also amazed to find so many kinds of bugs and things that they never knew were there.

VI. Limitations

Be sure to ask the janitor or grounds keeper if the plot site and time is acceptable.

Vii. Bibliography

BSCS - Green Version High School Biology, Rand McNally and Company, 1968. Pages 76-82 are of particular interest in this activity; this section is entitled "Study of a Biotic Community," and contains general investigation procedures, including the Berlese funnel procedure. The BSCS Green Version High School Biology text is a generally good and widely used text.

Phillips, Edwin A., Field Ecology (A Laboratory Block), D. C. Heath and Company, Lexington, Massachusetts, 1969. This is one of a series of laboratory blocks each of which provides for the investigation in depth of a specific topic in biology. The series has been developed by The Committee on Innovation in Laboratory

Instruction of the Biological Sciences Curriculum Study and has been supported by the National Science Foundation. This block itself requires approximately six weeks of time to complete in its entirety; however, many good activities can be found to supplement studies of any duration in field ecology.

Section 3, B

The Inconspicious Organisms

I. Introduction

This activity promotes student awareness of the variety and numbers of "between layer" organisms that are found under rocks and both in and under logs. The student investigates the organisms' structures and attempts to attribute certain structural adaptations to the "in-between" habitat and vice-versa. He also ponders the question of whether or not these structural forms lend themselves well to survival in this particular habitat. The activity is suggested for second grade and up and can last anywhere from one hour to a day or two.

II. Questions

1. To lead into the activity ask:
   a. Why do critters live under rocks and logs?
   b. What might prompt these "in-between" critters to live there?
2. To initiate the activity ask:
   a. What kinds of critters can you find in the "in-between" habitat?
3. To continue the activity ask:
   a. What structural similarities do the organisms have?
   b. Dissimilarities?
   c. What functions(s) can you attribute to these structural forms?
4. To expand the activity ask:
   a. Do these critters live in habitats other than under logs and rocks?
   b. What advantages does this habitat contribute toward survival?
5. To evaluate the students' efforts ask:
   a. Were the students enthusiastic about finding and examining the critters?
   b. Did the students react well to the questions?

c. Did they wish to continue the activity in any way?

III. Equipment

1. Tweezers, forceps
2. Baby food jars
3. Baggies

IV. Procedure

1. Send students as individuals or pairs to the area to be studied.
2. Students should investigate the area and collect samples of creatures that are found.
3. Turn over logs, sticks, rocks and collect critters.
4. Split open rotting logs and collect critters.
5. Take samples back to the classroom to be examined.
6. If a wooded area is not available for study, place a plank, bricks, or cinder blocks on a grassy section of an open lot. Allow them to sit for a week or two,and cryptozoa should then appear underneath.

V. Past Studies

Graduate students in a Temple University course entitled "Ecology and Field Biology " studied the applicability of this activity to the high school level. The work was carried out at the Schuylkill Valley Nature Center in Philadelphia, Pa. They found varied applications for the activity and were surprised to find the interesting outgrowths that can stem from it.

VI. Limitations

Younger children will find it difficult to attribute any reason to particular structural forms. Be sure to get permission from the grounds people, janitor, or land owner before you begin turning over rocks and things.

VII. Bibliography

BSCS - Green Version High School Biology, See Ch. I, Sec. 3, A.

Phillips, Edwin A., Field Ecology (A Laboratory Block), See Ch. 1, Sec. 3, A.

Section 3, C

Underworld Critters

I. Introduction

This awareness activity, suggested for second graders and up, promotes the student's awareness of the wide diversity and number of organisms that thrive in the ground. The activity introduces certain laboratory procedures, and can be carried out anywhere from the city (if some open ground can be found) to the backwoods. The duration of the activity can be from 2 periods to several daily periods if desired.

II. Questions

1. To lead into the activity ask:
   a. Where do animals live?
   b. Are there many kinds of animals that live in the ground?
   c. What kinds can you think of?
2. To initiate the activity ask:
   a. Do you think there are places on the school property where underworld critters live?
   b. Where should we look?
3. To continue the activity ask:
   a. Does your digging spot look like a good place for underworld critters to live?
   b. Why or why not?
   c. What kind of critters can you find?
   d. What do the critters do that makes them hard to catch?
   e. Are some critters found more on the surface ground and others found more deeply in the soil?
   f. What purpose does the light have in the Berlese funnel procedure?
   g. Why use white paper?

h. What purpose do the chemicals have?

i. Do you find more kinds of critters with the Berlese apparatus than you did just by breaking up the soil?

4. To expand the activity ask:

a. Why do some digging spots have more underworld critters than others?

b. What constitutes a good place for underworld critters to live?

c. What is the relationship between "underworld" critters and "overworld" critters?

d. What kinds of overworld critters eat underworld critters?

5. To evaluate the students' efforts ask:

a. Were students cooperative within their groups?

b. Did they wish to continue the activity in any way?

III. Equipment

1. 2 shovels per team

2. 4 cardboard boxes per team (use 8 paper shopping bags, if necessary)

3. A dozen baby food jars per team

4. Berlese Funnel Sample Set Up

a. Ether or chloroform

b. White paper

c. Light source (75 watt bulb)

d. Tweezers

e. Bottle and cap

f. Fornalin or rubbing alcohol

g. Funnel

h. Screening (scrape)

5. Microscope

IV. Procedure

1. Divide the class into teams of 4 or 5.
2. Send the students to the selected sites.
3. Let them collect a cubic foot of soil by digging a foot square 1 foot deep.
4. Put the soil in the cardboard boxes or bags. Cover. Seal. (Put some surface soil and loose organic litter in a baggie.)
5. In the classroom, sort the material to find the underworld critters. (Use the surface soil in the baggie to do a Berlese Funnel Sample.)
6. Put each kind in a separate jar.
7. Do a diversity index. (See activity entitled Classroom DI.)
8. Compare D.I.'s of the different locations.

V. Past Studies

Students are amazed at the number and diversity of organisms that they find in their diggings. The chemicals used in the Berlese funnel apparatus prompt many questions.

VI. Limitations

Get permission from the janitor or grounds personnel before you dig. If the school won't allow digging, look for a friendly school neighbor. Be careful about lifting soil; a cubic foot will weigh from 70 lbs. on up. Be careful to not let the students taste the alcohol, fornalin, ether, or chloroform; they will be curious.

VII. Bibliography

BSCS - Green Version High School Biology, See Ch. I, Sec. 3, A.

Phillips, Edwin A., Field Ecology (A Laboratory Block), See Ch. I, Sec. 3, A.

Section 3, D

Tanglefoot Board

I. Introduction

This awareness activity helps the student to become aware of the multitude of different flying organisms present in the air. A diversity index is computed for each of several investigation sites, and these are compared. The activity is suggested for students of grades four and up. The usual duration of the activity is about one week.

II. Questions

1. To lead into the activity ask:
   a. What kinds of organisms are airborne?
   b. What factors are required for their survival?
   c. How is their ability to fly an advantage?
2. To initiate the activity ask:
   a. How could you collect flying organisms?
   b. How could you be sure you had a representative sample?
3. To continue the activity ask:
   a. What structural similarities do the organisms have?
   b. How are they dissimilar?
   c. Judging by the side of the tile the organism is stuck on and the position of the tile in the tree, can you make any decision as to what direction a particular type of flying critter usually flew (whether it was toward the creek or away from it; toward the road or away from it, etc.)?
   d. If an organism seems to have this "directionality",why might this be ?
   e. What differences are apparent in the D.I.'s of the different areas?

Why?

4. To expand the activity ask:
   a. What predators prey upon these flying organisms?
   b. Does the probable predator density variation reflect a similar variation in the D.I.'s computed for each area?
   c. Why or why not? Explain.
5. To evaluate the students' efforts ask:
   a. Were the students interested in catching and examining the flying organisms?
   b. Did students react well to the questions?
   c. Did students wish to continue the activity in any way?

III. Equipment

1. Several light colored floor tiles (at least 6" x 6")
2. Common auto grease or vaseline
3. Wire (enough to hang each tile by two holes)
4. Drill, or large nail and hammer (to make holes in the tile)

IV. Procedure

1. Drill two holes, one in each of two consecutive corners of the tile, large enough for the wire to pass through.
2. Rig the wires in the corners of the tile in such a way that the tile can be hung from a tree limb or lamp post.
3. Thoroughly cover the tiles with grease; an even coating of 1/4" is usually sufficient.
4. Hang tiles on the limbs of trees in varied locations. Try to select trees that are in different types of habitats, i.e. lawn, field, by a street, creek bank, etc.
5. Return several days to a week later and check the tanglefoot boards for trapped insects. If a good number of insects are present, return

the tiles to the classroom for investigation.

6. Run a diversity index on each tile of different location and compare.

V. Past Studies

Student at Doyle Elementary School in Doylestown, Pa. were very interested to find that they could tell exactly when insect hatchings occurred in the streams. They would find very little on the boards for a certain time and then they would find high numbers of organisms, indicating a hatching.

VI. Limitations

Floor tiles covered with auto grease tend to be very messy. They should be handled by the hanging wires. In some areas, one week will not be long enough for a good sample.

VII. Bibliography

Odum, Eugene P., Fundamentals of Ecology, W. B. Saunders Company, Philadelphia, 1971. An excellent basic ecology text; world famous and widely used.

Section 4, A

Bites

I. Introduction

This awareness activity shows students in grades five and up why feral dogs are dangerous and what can be done about them. No special equipment or knowledge is required for this survey type activity, which shouldn't take more than an hour or two of actual class time.

II. Questions

1. Questions to lead into the activity:
   a. Do you like big dogs?
   b. Do you have a big dog?
   c. Who uses big dogs? Why?
2. Questions to initiate the activity:
   a. What do these big dogs do?
   b. What do feral dogs do?
   c. Do you know anyone who has been bitten?
   d. Why did they get bitten?
   e. What happened to them?
3. Questions to continue the activity:
   a. Are other people bitten? Who? How many?
   b. Where can we find out?
4. Questions to expand the activity:
   a. What can we do to cut down on bites?
   b. How do you treat a dog bite?
   c. How much would it cost you if you were bitten?
   d. What else do dogs do that endangers our health?

5. Questions to evaluate the activity:

   a. Did students see why bites are a problem?

   b. Did students see that bites are not the only problem?

III. Equipment

No equipment other than a telephone to get information is required.

IV. Procedure

After the students have figured out who would know the answers to the questions they didn't, have them call him on the telephone or better yet, go to his office for an interview.

V. Limitations

The only limitation foreseen is that the people with the information might be uncooperative. This could be minimized by telling why you want the information, what you're going to do with it, etc., but always be honest and polite.

VI. Past Studies

In connection with a study of feral dogs, a graduate student at Johns Hopkins University in Baltimore, Maryland did a study of the frequency and severity of dog bites in Baltimore. His data was based on medical records.

VII. Bibliography

Beaver, D. C., Faust, E. C. and Jung, R. C., Animal Agents and Vectors of Human Diseases, Lea and Febiger, Philadelphia, Pa., 1968. A very technical medical resource. Not applicable to layman.

Beck, Alan M., "The Life and Times of SHAG, A Feral Dog in Baltimore," Natural History Magazine, American Museum of Natural History, New York, New York, October, 1972, pp. 58 through 65. A scientific article

written with a sense of humor that anyone can understand. Beck points out interesting ecological relationships that are found in feral dogs as well as the distant animals often used in ecological texts. His work seems very easily reproduced although maybe to a lesser extent, but 5 of our dog walks have really turned people on!

"Consumer Watch (A Good Season to Beware of Dogs)", Life Magazine, Time, Inc., Chicago, Ill., August 18, 1972, p. 72. A good although brief informative article about how the number of dog bites is on the rise in big cities such as New York and Baltimore.

Frank, Norman, "A Resurgence of Rabies", Natural History Magazine, American Museum of Natural History, New York, New York, May, 1972, pp. 14-19, 80-84. An excellent article on the fast spreading rabies epidemic. The article used a specific case in Florida where several dogs had been infected by rabid raccoons.

Section 4, B

Dog Walk

I. Introduction

This awareness activity can really turn people on and get them interested and involved in the dog problem. It is a basic activity that is used in conjunction with other activities such as "Approachability", "Canine Customs", "Photo Peterson" and "Territorial Imperatives" as well as an introduction for any dog activities. Plan on a two or three hour walk plus at least one hour of discussion after for students grades seven and up. Anyone, a class, community group, or interested people can do this activity as equipment required for it is minimal.

II. Questions

1. Questions to lead into the activity:
   a. What are a dog's needs and dislikes?
   b. Where and when would these be in conjunction?
2. Questions to initiate the activity:
   a. What should we know before setting out?
   b. What will we want to know (observe) when we get there?
   c. How can we be sure we won't disturb the dogs?
3. Questions to continue the activity:
   a. How can we cover the most area in the least amount of time?
4. Questions to expand the activity:
   a. How many dogs are owned?
   b. Do you see any "BEWARE OF DOG" signs?
   c. How do the dogs react to us?
5. Questions to evaluate the activity:
   a. The more questions about food, shelter, mortality, pack size,

and anything else regarding dogs, the better.

III. Equipment

A notebook or pad and pencil is a must unless a portable tape recorder is employed. The tape recorder is best. A camera and thermometer are both optional, but helpful. Maps are good too.

IV. Procedure

Assemble the interested people (not just the class) 1/2 hour before sunrise at a pre-designated location to go over last minute instruction, and then split up into groups of three or four people to cover a specific area. Have each person in each group be in charge of certain observations. Make sure someone is recording all observations. A tape recorder is expensive, but highly recommended because it is hard to write observations and walk at the same time.

V. Limitations

Unfortunately this activity has several limitations. Dogs may not be around, or the neighborhood where they are found may present a hazard. Then, too, there is always a question of working with feral dogs. (See the Limitations section in "Approachability") The main deterent for a lot of people, however, is that they don't like getting out at 4:30 in the morning. But after they do, chances are, they'll be glad they did.

VI. Past Studies

During a summer workshop in Cleveland, Ohio, fifty students and teachers assembled on a street corner at 5:00 a.m. A wide variety of experiences occurred: impromptu interviews, overly friendly dogs, feral cats and sleepy people.

Three students, two of whom had been on the Cleveland Dog Walk, organized a Dog Walk in an old suburban Philadelphia housing project and observed over 30 dogs in two hours.

A data sheet from these two dog walks follows:

Date_____ Time _____to_____

Observers_____

Weather/Temperature_____

Location_____ Last garbage pick-up_____

Dog or Pack (if recognized)_____

How many_____

Sex_____ Size_____ Type_____

Color_____ Distinguishing Marks_____

Collar?_____ Intra-Pack distance_____

Source_____

Destination (including activity)_____

_____

Reaction to observers/Flight distance _____

_____

Relationships to Dogs, Cats, Rats, People, Packs, Cars, Garbage__

_____

Ratios Dog(s) to Houses, Garbage, Litter, Abandoned Buildings, People, Time, Weather, Packs, With/Without Collars, "BEWARE OF DOG" Signs_____

_____

Pack Size Frequency_____

VII. Bibliography

Ardey, Robert, The Territorial Imperative (A Personal Inquiry Into the Animal Origins of Property and Nations), Kingsport Press, Inc., Kingsport, Tennessee, 1966. Robert Ardrey takes a concept familiar to every biologist (that of territory), and brings together for the first time a fair sampling of this form of behavior and demonstrates that man obeys the same laws as (other) animals. Cost: $6.95.

Beck, Alan, The Life and Times..., See Ch. 1, Sec. 4,A.

"Consumer Watch", See Ch. 1, Sec. 4,A

"Do Cities Really Need Dogs (Do It For Mama)", Time Magazine, Time, Inc., New York, New York, July 20, 1970, p. 35. A well written article on the problem of over-population of dogs in large cities, expecially New York.

"Dog Fight (Are City Streets Going to the Dogs?)", Newsweek Magazine, Newsweek, Inc., Dayton, Ohio, April 12, 1971, p. 95. Gives a brief story on the over-population of dogs in urban areas.

Holmes, C. R., "Let's Defuse Dogdom's Population Explosion", Science Digest, New York, New York, May, 1972, pp. 68 through 73. A good article on the dog population problem around the world.

Klopfer, Peter H., Behavioral Aspects of Ecology, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1962. A very good concise book dealing with topics such as "Why don't predators overeat their prey?", "How are food and space shared between species?", "Why does species diversity vary?", "How are species kept distinct?", and "How are communities organized?" It is too technical at times and the subject index is lacking but overall it is thorough and quite concise.

Schoenstein, Ralph, "What Even Your Best Friend--The Dog--Won't Tell You (Unless We Step Smartly We're Going to Land in a Lot of Trouble)", Today's Health, Chicago, Ill., July, 1971, pp. 50 through 53.

A brief humorous story on the over-population of dogs.

Section 4, C

Canine Code

I. Introduction

This awareness activity can be used with any class grade five or above depending on the depth gone into. It should show what laws we have (or don't have) regarding dogs and why they are (or aren't) enforced. It should take two or three hours at least but will probably be spaced out in a week or two as needed.

II. Questions

1. Questions to lead into the activity:
   a. Why do we have laws?
   b. Are people the only ones who do things wrong?
2. Questions to initiate the activity:
   a. What do dogs do wrong?
   b. Do we have laws against this?
3. Questions to continue the activity:
   a. Are these laws enforced?
   b. Who enforces these laws?
4. Questions to expand the activity:
   a. Where can we go if we see some wild dog that should be removed? if we see a dog deficating on the sidewalk?
5. Questions to evaluate the activity:
   a. Did the students know where to go to get the information needed?
   b. Did the students find out what they now can do about the dog problem in a legal way?

III. Equipment

Telephones should be used (if students can't get interviews) to contact

public officials about what laws are on the books. A large roll of butcher paper is good for charting all the laws and responsible agencies.

IV. Procedure

After deciding who is going to know what, get the students talking to public officials about dog laws. After all the information is gathered, have the students chart each step of each law and the responsible agency on large butcher paper.

V. Limitations

Public officials might not know anything or they might be just plain uncooperative.

VI. Past Studies

Students at George School in Newtown, Pennsylvania, did a study of all laws concerning water quality in the Delaware River Basin,and they charted it on large paper.

VII. Bibliography

Beck, Alan M., "The Life and Times of SHAG, a Feral Dog in Baltimore", See Ch. I, Sec 4, A.

Kupecky, Gini, "To Scoop or Not to Scoop", New York Times Magazine, New York, New York, August 20, 1972, pp. 63 through 72. A good article about the battles in New York City over the dog problem. Has a lot of information about both pro-dog and anti-dog organizations.

Schoenstein, Ralph, "What Even Your Best Friend...",See Ch.1, Sec. 4, B.

Section 4, D

Dog Catcher

I. Introduction

To fully understand the dog problem one must also understand the people connected with it, and so this awareness activity is designed to provide an in-depth look at your friendly neighborhood dog catcher. Several students (grades seven and up) could spend a whole day with the dog catcher on his rounds, but otherwise this would be a one or two hour activity for students grades five and up.

II. Questions

1. To lead to the activity ask:
   a. Do you have a dog catcher?
   b. How do you know?
2. To initiate the activity ask:
   a. How often do you see the dog catcher?
   b. What does he do?
   c. Would you want to be a dog catcher? Why or why not?
3. To continue the activity ask:
   a. How much is the dog catcher paid? By whom?
   b. Are people satisfied with him?
4. To expand the activity ask:
   a. Does anyone else catch dogs?
   b. What happens to dogs that are caught?
5. To evaluate the activity ask:
   a. Were the students able to determine a dog catcher's social status?
   b. Did the students gain respect and knowledge of the dog catcher?

III. Equipment

There are no equipment requirements except for a telephone if the students are unable to answer the questions and want to find the answers.

IV. Procedure

Suggest this activity be attempted after students have completed the dog walk, interviewed residents, examined the laws, and have a thorough understanding of some of the political sensitivities about dogs.

Write, telephone, or - better - visit the warden first, tell him about the plan, and determine precisely what kind of authority he needs to transport your students. We have found that the wardens are very anxious to help, but the bureaucrats above them simply don't know how to cope with the request and fend it off by saying, "It's not allowed." Therefore, see the warden first. Remember, the warden also issues citations to ordinance violators, and he may not be a very popular man.

V. Limitations

The car, the dogs, the tranquillizing, the citing can all be exciting experiences. But these should be opportunities for leading into new investigations, about other ordinances, the position of the dog owners, their record of compliance, the functioning of a warden in a vastly complex relationship between man and dog.

Many opportunities exist, but the students need to capitalize on the background information; again, we suggest that since this is probably a one time event, the participants have had ample experience to merit the trip. You may also be imposing on the warden, so define your expectations before starting the trips.

VI. Past Studies

Mr. Charles Sheppard, the dog warden in East Cleveland, transported 3-4

students for 30-60 minutes each, over a period of one month, until he had carried 150 5th graders from Prospect, Chambers, and Mayfair Elementary Schools. The students spotted dogs, which he caught; they observed the service of citations - and heard the complaints!; they discovered many of the frustrations of his job; they also found that he had many personal hobbies, including motorcycle racing, raising animals, and others. Either before or after, all students made early morning walks, photographed dogs, interviewed residents, followed the disposition of dogs after apprehension - to police or Animal Protective League kennels, sometimes from there to K-9 Protectors, Inc., a guard-dog training organization.

VII. Bibliography

Institute for Environmental Education - Case History, Series F, "A Fifth-Grade Environmental Awareness Project", describing the dog study and a consumer, mini-park, and rapid transit study.

Section 4, E

Canine Customs

I. Introduction

This is a survey-type awareness activity for grades five and up that is done in connection with a "Dog Walk". It has implications for both Approachability and Territorial Imperatives and so is a very simple and exciting activity to do.

II. Questions

1. To lead to the activity ask:
   a. Do dogs share?
   b. How do dogs protect themselves?
   c. Do dogs specialize?
2. To initiate the activity ask:
   a. How do dogs behave with other dogs? with animals? with people?
3. To continue the activity ask:
   a. Do pack sizes vary?
   b. Do packs interact?
4. To expand the activity ask:
   a. What does it show if pack sizes vary?
   b. How frequent is a certain pack size?
5. To evaluate the activity ask:
   a. Were the students able to relate pack size with environmental factors?
   b. How accurate were the pack-size frequency estimates?

III. Equipment

No special equipment is needed except that which is needed for Dog Walk.

IV. Procedure

During a dog walk have the kids keep tabs on the packs, their size, frequency,

body language, intra-pack distance, and activities.

V. Limitations

Just those present when working with feral dogs (see Limitations of "Approachability").

VI. Past Studies

Students and teachers in Cleveland, Ohio, made a brief study of packs and their behavior in the summer of 1972.

A graduate student at Johns Hopkins University in Baltimore, Maryland, made a study of dogs, their packs and behavior for his thesis.

VII. Bibliography

Ardrey, Robert, The Territorial Imperative, See Ch. 1, Sec. 4, B.

Beck, Alan M., "The Life and Times"..., See Ch. 1, Sec. 4, A.

Frame, George W., Wild Dogs of Africa, Science Digest, New York, New York 10019, June 1970. A good article of how wild dogs (in packs) behave in an undisturbed environment.

Klopfer, Peter H., Behavioral Aspects of Ecology, See Ch. I, Sec. 4, A.

Schaller, George B., Predators of the Serenget: Part 2, Natural History Magazine, American Museum of Natural History, New York, New York 10024, March 1972. An excellent article overall, this part (#2 of 3) has a very good account of the activities of naturally wild dogs.

CHAPTER II

Chapter II contains "Transitional Activities" on birds and dogs. Preceding these is one activity on statistics, to further emphasize the kinds of related studies that can be used when they are requested; it is a tool that is used in one of the activities.

Again, any number of activities could be undertaken at one time by the class. By this time, however, students will ideally be working as one large team with divided responsibilities; therefore, the relationships among the individual assignments to the whole should be made periodically. For example, both bird and dog studies can be conducted at home and en route to and from school. Observations here extend the scope of the activity and build the bond between school and community.

These activities are intended to begin developing a comprehensive understanding of environmental relationships, preparatory to embarking on an operational, or service, program. The focus should begin to be a problem, disciplines to become tools with which to work on that problem, and the direction of the investigations should be determined by outcome of the study. That is why these activities are guides, not texts.

Section 1

Population Estimation

I. Introduction

In this classroom activity a batch of beans represents a living population. Students use the Peterson Population Estimation Formula to estimate the number of beans in the batch. In doing so students are exposed to the ideas of random sampling, marking, and distribution. They work with a particular formula, data tables and graphs and attempt to draw conclusions concerning the validity of their data. Concepts might be grasped by upper elementary students, however, the junior high level is recommended.

II. Questions

1. To lead into the activity ask:
   a. What is population?
   b. What is a population?
   c. Is there any way we could find out how many fish are in a pond, or how many rats are on a city block?
   d. Is it practical or even possible to count them all?
2. To initiate the activity ask:
   a. What is a random sampling of a population?
   b. What makes it "random"?
   c. Does uneven distribution affect the "randomness" of a random sampling?
   d. How can the sample be taken to correct this?
3. To continue the activity ask:
   a. What do the marked beans represent in the population? (The animals that were caught, marked, and released in the first sampling.)

b. What happens to the accuracy of the population estimate as the number of beans in the random sample increases? Why?

4. To expand the activity ask:

   a. Can the Peterson Population Estimation Formula be used in estimating the size of living populations?

   b. What is necessary for this to be done? (Methods of capturing, marking and releasing animals)

5. To evaluate the students' efforts ask:

   a. Did all students appear to be working willingly and to their capacity?

   b. What part of the discussion/activity seemed to interest them most?

   c. Were the students able to draw adequate conclusions concerning the activity?

   d. Were students able to relate the bean "population" to a living one?

   e. Do they want to continue with another population study?

III. Equipment

Equipment can easily be adapted to availability, especially concerning the bean marking method.

1. A one pound bag (any kind) of light colored beans (black-eyed pea size) containing about one thousand beans, is sufficient for a group of 4 students.
2. Tempora-waterpaint
3. Strainer
4. Buckets to pour and catch paint
5. Paper for data tables similar to the one following:

m	10	20	30	40	50	60	70	80 etc....
u								
r								
p								

IV. Procedure

1. Count out in advance 1000 unmarked beans and roughly 200 marked beans for each group of 4 students. Students can help with the counting and marking the day before the activity. A method of marking which is more economical and more ecologically sound than the use of spray paint is to pour a water base or tempora paint through a kitchen strainer of beans, catching the paint in another bucket.
2. Begin by having students form groups of four. Each group should have 1000 unmarked and 200 marked beans.
3. Have each group begin by adding 10 marked beans and removing 10 unmarked beans from the batch.
4. Insure that students mix the beans well, and then have each group remove a handful.
5. Students should then compute "p" using the Peterson Population Estimation Formula:

$$p = \frac{m(u+r)}{r}$$

p = the estimated population

m = the number of individuals marked and released in the precensus

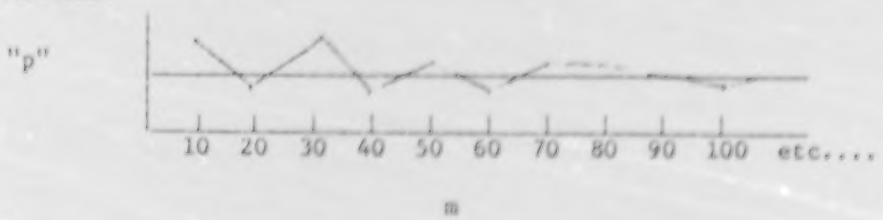
u = the number of unmarked individuals caught in the postcensus

r = the number of marked individuals caught in the postcensus (returns)

The precensus is the first sampling (in this activity the first "p" determination precensus is 10 - the marked beans that were added to the bean "population"). The postcensus is the second sampling. When sampling a living population, ample time must elapse between the two samplings for the marked individuals to become randomly distributed in the population. For most wild populations this time should be at least one week; however, local conditions may shorten or lengthen this time.

6. Students should continue adding 10 marked beans,removing 10 unmarked beans and computing "p" until 150 marked beans are added, keeping a data record of each "p" computation.
7. A final step is to count all the beans if the actual count is not already known.

   By analyzing the computed "p" values, knowing the actual "p" value, the students can determine which combinations of m, u, and r yield the best estimates of "p". A convenient method of examining this relationship is to graph "p" values vs. the increasing "m" values, as follows:



V. Past Studies

In conjunction with the annual draining of the George School Pond at George School, Newtown, Pa., a pond population is estimated using this method. The students clip the end of a pectoral fin of the fish caught in the precensus. Three weeks are allowed to pass between the pre- and

postcensus to insure even distribution of marked fish in the pond. Upon completion of the postcensus and computation of the estimated population, students for the past seven years have invariably asked how accurate the estimate really is. In response to this question, George School faculty and students begin the routine draining of the pond and make an actual count of types and numbers of fish. (Drainage is done to maintain a desired balance in the fish population. Fish are stored in a nearby stream while the pond refills.) Alan P. Ternes, executive editor of Natural History magazine has also used the Peterson technique in urban areas to determine dog populations. The precensus and postcensus were photographs taken of a city block from the same spot at the same time in the early morning. Dogs are found to be positively identifiable in the photographs, where domestic cats, for instance, are not.

VI. Limitations

Limitations in the classroom activity can be attributed to the time and tedium involved in counting out beans. It is advisable to use student power to aid in this task.

VII. Bibliography

Ehrlich, Paul R. and Anne H., Population Resources Environment, W. H. Freeman and Company, San Francisco, Cal., 1970. Detailed analysis of the worldwide crisis of over-population and the resulting demands on food, resources, and the environment. Taking a broad ecological approach, it shows that problems of modern society such as environmental deterioration, hunger, resource depletion, and war are closely related. Authors draw upon a wide diversity of sources and offer many constructive proposals that might help to brighten the gloomy prospects

portrayed. An excellent sourcebook for high school and above.

Freund, John E., Modern Elementary Statistics, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1960. This text acquaints students with theoretical aspects of statistics. Recommended for high school students.

Huff, Darrell, How to Lie With Statistics, W. W. Norton and Company, 1954. This book is a study of the use and misuse of statistics. It is written in a humorous style and can be understood by high school students. Available in paperback.

Lagler, Karl F., Freshwater Fishery Biology, Wm. C. Brown Company, Publishers, Dubuque, Iowa, 1952. A broadly comprehensive volume dealing with the principles and methods of modern fishery research and management on the inland waters of Canada and the U.S. Much of material is of value to students of ichthyology, marine fisheries, and various aspects of hydrobiology. The book contains a section entitled "Methods of Population Enumeration," which explicates various population estimate formulas, including the Peterson formula.

Reichman, W. J., Use and Abuse of Statistics, Oxford University Press, New York, 1962. A general work on statistics designed for the high school level which covers the calculation of statistics and their use and abuse.

Section 2, A

Chow Chewing Checking Charting

I. Introduction

The purpose of this activity is to determine at which time of the day birds feed most actively. In most cases the observations will be made at a feeding station which the students establish. This activity will take place after the stations from a previous activity have been up for a while, so the birds have had a chance to learn that they can depend on the station for food. The activity consists of observations made over a period of time so that the pattern may be determined if one exists. No special equipment other than a feeding station is needed, and the activity can be conducted by students grades three and up. Results are presented graphically.

II. Questions

1. To lead into the activity ask:
   a. What does a bird do most of the day during the non-breeding season?
   b. Where do birds feed?
   c. How much of a day is spent in pursuit of food?
2. To initiate the activity ask:
   a. Do birds have a feeding period pattern?
   b. How closely does it coincide with human patterns (breakfast, lunch and dinner routine)?
   c. How regular are birds in their feeding periods from day to day?
3. To continue the activity ask:
   a. Is determining feeding periods from making observations at a feeder accurate?

b. Can the data be represented graphically?

c. What are possible explanations for why a pattern was or was not formed, based on the outcome?

d. When are birds most avid in their pursuit of food?

4. To expand the activity ask:

a. What can interfere with or interrupt feeding patterns?

b. Does the metabolic rate of a bird differ from that of men?

c. Which foods provide the most energy for birds?

d. What are the nutritional and caloric requirements of birds?

5. To evaluate the activity ask:

a. How diligent were the students in pursuit of data?

b. What was learned in terms of process?

c. What was learned in terms of content?

d. What was the enthusiasm level of the students.

III. Equipment

1. Feeding stations
2. Feed
3. Data sheets - pencil, graph paper
4. Camera
5. Binoculars (if helpful)
6. Bird blind (if needed)

IV. Procedure

1. Establish standard observation times. This may be every 10 minutes, hourly, four times a day, etc.
2. Establish who will collect data and when.
3. During the observations, count only the numbers of birds using the feeders. An estimate may be made for times of great activity.

4. Plot these numbers on a graph with numbers of birds on the y-axis and the time intervals on the x-axis.
5. Evaluate the results.
6. This activity might well expand into a study in which students observe the feeder activity over one or several 24-hour periods.

V. Past Studies

1. Students usually find a marked decrease from morning to noon with a slight increase in activity towards evening. Weather is often found to upset that routine.

VI. Limitations

1. Observation time may be difficult, as bird activity does not necessarily coincide with class time. In this case, the students will have to collect data outside of class time.
2. If birds are not attracted to the feeders, then the activity must be relocated, perhaps to take place as a weekend field trip or near a feeder that is already established.

VII. Bibliography

Van Lausch-Goodall, Jane, Tool-Using Bird: The Egyptian Vulture, National Geographic Magazine, Washington, D. C. 20036, May 1968. Suitable for grades seven and up; describes a bird which uses tools and the expedition.

Section 2, B

The Order of G.R.A.B. (Gouging Rations Among Birds)

I. Introduction

In this activity students attempt to reveal the existence of a peck order among birds at a feeding stations. This is primarily an awareness activity, suitable for most grade levels. Peck orders are often described in a biology text, but this activity allows the students to really see what a peck order consists of. If feeders, food, and a suitable place from which to make observations are established, then the only special equipment needed might be binoculars. Data collected from previous feeding station activities may be helpful at this time, although it can be treated as an activity independent of all others.

II. Questions

1. To lead into the activity ask:
   a. How often do individual birds feed at the feeder?
   b. How often do groups of birds feed at the feeder?
   c. Are these groups members of the same species?
   d. Do members of different species feed at the same time?
   e. Do the groups descend upon the feeder all at once?
   f. What activity takes place at a feeder other than feeding?
2. To initiate the activity ask:
   a. Is there any set order into which feeding birds fall?
   b. Are some members of the same species more aggressive than others?
   c. Is this due to their sex?
   d. Is this due to their age?
   e. Who are the aggressive members when more than one species is involved?

3. To continue the activity ask:

   a. Do some species of birds "run" a feeder?

   b. Is aggression active or implied?

   c. Do some species or members of the same species automatically give ground before aggression has actually been shown?

   d. If several species are involved, and the dominant members are absent, how is the peck order affected?

   e. What constitutes aggression (voice, physical contact, etc.)?

4. To expand the activity ask:

   a. How does the intrusion of other birds on a group which is feeding affect peck order?

   b. Does the peck order at the feeder assume the same form outside of feeding?

5. To evaluate the activity ask:

   a. What was the interest level among the students?

   b. What was the quality of the observation?

   c. What conclusions were drawn?

III. Equipment

1. Feeding station
2. Feed
3. Notebook, Pencil, Data format
4. Binoculars (optional)
5. Bird blind (if needed)
6. Camera (if desired)

IV. Procedure

1. Have students devise a uniform method of collecting data, having gone through the questions. This may consist of a formal data sheet, or mere guidelines to help achieve the most useful data possible. Include

information, e.g., time and weather, which might be important to the feeder activity, as well as species involved.

2. Place several kinds of food on the same feeder to attract as many different kinds of birds to the same place.
3. Determine the time(s) at which it is best to collect data.
4. Collect data, and evaluate the observations.

V. Past Studies

1. Students have been amazed at the ability of a pine siskin to control a feeder with evening grosbeaks on it.

VI. Limitations

1. Time may be a limitation since the best time for feeder observation does not coincide with class time. Therefore, this activity may have to take place as more of an assignment type activity.
2. If it is not possible to establish feeders in the environs of the school, perhaps a day or weekend in the field will allow this activity to take place.

VII. Bibliography

Guhl, A. M., The Social Order of Chickens, Scientific American, W. H. Freeman and Co., 660 Market Street, San Francisco, Calif. 94104, February, 1956. Peck orders are detailed. The emphasis has to do with sexuality rather than peck order and feeding. The contents would need to be abstracted for grades 10 and under.

Lanyon, Wesley, E., Biology of Birds, Natural History Press, Garden City, New York, 1963. Suitable for grades seven and up as a non-identification oriented reference. Chapters cover origin and evolution, design for flight, variations on a general theme,

migration and navigation, distribution and the environment, courtship and reproduction, growth and survival.

Saunders, A. A., A Guide to Bird Songs, Doubleday, New York, New York, 1951. Presents a unique method of recording bird voices through diagrams. A key to bird songs is included. 200 different songs are diagrammed. Grades nine and up might attempt to decipher the curious code used.

Section 2, C

Pecky Picky Packy

I. Introduction

The purpose of this activity is to determine if there is a preference for different kinds of foods among birds. It can be conducted as an awareness activity, because students make first hand observations about food preferences and evaluate the observations. Much of the observing will probably take place outside of class time, and the experiment can extend over as long a span of time as desired. Other than bird seed and bird feeders, no special equipment is needed. This activity is suitable for any grade level.

II. Questions

1. To lead into the activity ask:
   a. What nutrition requirements do birds have?
   b. What do birds eat?
2. To initiate the activity ask:
   a. Do birds prefer certain foods?
   b. Do they prefer them for taste?
   c. Do they prefer them for availability?
   d. Do they prefer them for texture?
   e. Do they prefer them for the time of year?
3. To continue the activity ask:
   a. Do different species of birds eat different foods?
   b. Do different birds of the same species prefer different foods?
4. To expand the activity ask:
   a. How persistent are birds about obtaining the foods they prefer?
   b. How are food preferences acquired?

5. To evaluate the activity ask:

   a. What types of results were obtained?

   b. What conclusions were attained?

   c. How efficient was the execution of the experiment?

III. Equipment

1. For conducting the investigation in a closed situation, needs may include:

   a. Bird feeders

2. For field observation the following materials might be used:

   a. Binoculars (up to 8X if possible)

   b. Bird blind

   c. Camera

3. Foods which may be used include:

   a. Suet

   b. Peanut butter

   c. Sunflower seeds

   d. Hemp

   e. Millet

   f. Meat

   g. Cracked corn

   h. Nut meats

   i. Dog biscuit

   j. Chaff

   k. Raisins

   l. Dried berries

   m. Frozen fruits

   n. Oranges

   o. Bananas

   p. White bread

q. Crumbs

r. Salt

s. Grit

t. Pellet-form rabbit food

u. Cooked spaghetti

v. Boiled potatoes

w. Fatty meats

x. Apple peelings

y. Small grains

z. etc.

4. For data collections, needs include:

a. Notebook and pencil; or

b. Blackboard and chalk

IV. Procedure

Note: This is a sample procedure, of which many variations are possible.

1. Set up two pole feeders. Place them close enough to each other so that the surroundings will not introduce many variables because of extreme contrast.

2. Put sunflower seeds in one feeder and on the ground below it.

3. Put only mixed seeds (without any sunflower seeds) in the other feeder and on the ground below it.

4. Observe each feeder at strategic time intervals and note how many birds of each species are using each feeder.

5. Chart results; show which feeders attracted which species.

V. Past Studies

1. The two feeders described in the procedure need not be the only feeders in use. They may be set up in already established stations.

different foods might be tried, too.

2. This is usually an effective method of showing differences in feeding. With a good variety of birds, differences should be quite clear.

VI. Limitations

1. Precautions must be taken if continued ground feeding will take place. If a large number of birds are attracted, they may deposit wastes, some carrying disease, thus contaminating foods and spreading disease.

2. A suitable place for the feeders is needed. If location near the school is a problem, the activity may have to take place as a one day expedition to a "good" area.

VII. Bibliography

Brower, Lincoln Pierson, Ecological Chemistry, Scientific American, W. H. Freeman and Co., 660 Market Street, San Francisco, California 94104, February 1969. Extremely interesting article - would need to be abstracted for grades 10 and under. Describes experiments done with blue jays and monarch butterflies, the titles of which were emetic or non-emetic depending on if they were raised on plants (in this case milkweeds) which produced substances poisonous to vertebrates, yet palatable to insects, which the vertebrates can ingest. It also describes how the consumption of emetic as well as non-emetic caused the birds to develop "tastes" and repulsions.

Section 2, D

Keeping Abreast of Unrest and the Guests and Pests in a Nest

I. Introduction

The purpose of this activity is to become familiar with the nesting activities of birds. This is done through firsthand observation over a period of time - either that of a day, or daily checks over a longer span. Because the detailedness of the observation can vary, so can the age range of students - no restriction here. This is primarily an awareness activity, but prolonged involvement might lead to a problem study - say if conducted at a site where the environment is scheduled to change. Special observation equipment may be needed.

II. Questions

1. To lead to the activity ask:
   a. When do birds nest?
   b. Do all birds build a nest?
2. To initiate the activity ask:
   a. What goes on at a nest?
   b. What is the location of the nest?
   c. When is the nest needed?
   d. Is the nest being changed by the birds?
   e. Are there any eggs in the nest?
   f. Are there any young in the nest?
   g. When is the best time to observe the birds?
3. To continue the activity ask:
   a. How close is the nest to vital needs of the birds?
   b. Does the same bird who built the nest live in it now?
   c. What bird incubates the eggs?
   d. In which direction does it sit?
   e. How often are the young fed?

f. Are the young brooded? For how long?

4. To expand the activity ask:

a. Can any generalization be made about the birds who occupy the nest, regarding the structure of their lifestyle?

b. What relationships exist among the birds, especially male and female roles?

c. How long will the nest be used?

d. Of what significance are the observations?

e. How do these compare with those of other studies?

5. To evaluate the students' efforts ask:

a. How detailed were the observations made?

b. To what degree was the data evaluated and used?

c. What was their reaction to the activity?

d. How good was their cooperation?

III. Equipment

1. Notebook

2. Pencil

3. Clock or watch

Note: The following may be needed.

4. Binoculars (up to 8 X, if available)

5. Bird blind (see references in bibliography)

6. Ladder

7. Camera

8. Tape recorder

IV. Procedure

1. Find an occupied nest, where activity takes place.

2. The observer(s) should be in a good position to be able to see all that happens without disturbing the birds. Depending on the location, binoculars may be necessary. A bird blind is a closed tent-like structure which conceals the observer from the birds, but has an opening which enables observation. See bibliography for construction references. Positioning depends upon accessability, season, weather, and height of the nest.
3. Take detailed written notes on everything that happens at the nest. Use questions as a guide. A data sheet may be prepared in advance.
4. A photographic record may be helpful. Consult references on bird photography.
5. A tape recorder may be helpful for song studies. All observations could also be recorded and later transcribed if the voice of the observer will not bother the birds.
6. A comparison of findings may be conducted. The Bent Life History Series may be of particular help (see bibliography).

V. Past Studies

1. During three summers of observation of different Indigo Bunting nests, one student found that the male never came to the nest.
2. The Bent Life History Series gives detailed case histories and covers the nesting process of every North American bird.

VI. Limitations

1. Finding a nest of suitable location could be a problem; the students probably will be able to assist in finding one.
2. Time can also be a problem - either observation periods, season, or hour. It may be necessary to have the class conduct the activity not during class time, but rather when conditions are best.

VII. Bibliography

Armstrong, Edward A., The Way Birds Live, Dover, Inc., 180 Varick Street, New York, New York 10010, 1967. Students grades 6 and up can appreciate this informally written book; illustrations are frequently interspersed. The sixteen chapters cover finding a partner, showing off, sign language, battles and bluff, courtship gifts, setting up house, about eggs, youngsters, toilet and tidiness, do birds go to school, come out and play, dancing grounds, what's for dinner, roosting rules, over the hills and far away, and how to go birding. Much is written in first person, describing experiences of the author.

Bent, Arthur Cleveland, Bent Life History Series, Dover Publications, Inc., 180 Varick Street, New York, New York. The interested high school student will make use of this encyclopedic compilation. Detailed data is given on many species of birds on practically any item needed. Illustrations not abounding.

Rayn, Pat, ...and a Partridge in a Palm Tree, Sports Illustrated Magazine, January 11, 1971. Describes how an annual bird kill became a count; a team sport at that. Suitable for grades 6 and up.

Star, J., The Great Purple Martin Controversy, Look Magazine, August 10, 1971. An excellent example of how human activities interrupt the lives of birds; and what remedial action was taken. Focus on the mosquito problem. Grades 4 and up.

Section 3, A

Approachability

I. Introduction

This activity concerns itself with how close one species can get to another. It can be used as a preliminary for "Territorial Imperatives" or by itself to get across ideas such as "flight distance". As it is a survey type activity, the more time spent the better, but it could easily be done in an hour or two during a dog walk by fifth graders and up.

II. Questions

1. To lead to the activity ask:
   a. Do all people like dogs?
   b. What do these people do to dogs?
   c. What do the dogs do?
2. To initiate the activity ask:
   a. Do dogs learn to stay away from people?
   b. How close can we get to dogs:
      Standing up? Squatting? Crawling?
3. To continue the activity ask:
   a. How do dogs react to ropes and nets?
   b. How do numbers of people or dogs affect how close we get?
4. To expand the activity ask:
   a. Can dogs identify dog catchers? (See "Dog Catcher" activity.)
5. To evaluate the activity ask:
   a. Did students see how territory comes into play?
   b. Did students see that dogs aren't the only animals to which these rules apply?

III. Equipment

No special equipment is needed but a pad and pencil. A tape recorder is also very handy for taking field notes. Cameras could also be helpful.

IV. Procedure

During a dog walk confront dogs in different numbers with people moving (slowly) toward them, also in different numbers. Note the flight distance and/or barking distance of either or both parties. Try variations instead of standing. Try squatting or crawling.

V. Past Studies

On a dog walk in Cleveland, Ohio, several student and teacher groups noted flight distance in relation to the numbers in both parties. It seemed that when the aggressors outnumbered the ones approached, the flight distance increased significantly.

VI. Limitations

Provided dogs are found, the only limitations foreseen are the safety factors involved when working with feral dogs. Students and teachers should be warned not to be afraid, or at least not to show it, to make sudden moves, not to run. A small can of aerosol dog repellant such as HALT can provide security as well as safety.

VII. Bibliography

Ardrey, Robert, The Territorial Imperative, See Ch. 1, Sec. 4, B.

Beck, Alan M., "The Life and Times ...," See Ch. 1, Sec. 4, A.

Klopfer, Peter., Behavioral Aspects of Ecology, See Ch. 1, Sec. 4, B.

Section 3, C

Photo Peterson

I. Introduction

Grades seven and up can do this transitional activity which provides some very valuable data relative to the dog problem, namely how many dogs there are. This activity is done on two dog walks so no extra time need be allotted.

II. Questions

1. To lead to the activity ask:
   a. How many different dogs do you see each day? Each two days? Each week?
2. To initiate the activity ask:
   a. How many dogs don't you see?
3. To continue the activity ask:
   a. How many dogs are there?
   b. How can we find out?
4. To expand the activity ask:
   a. How accurate is our estimate?
   b. How can we check it?
5. To evaluate the activity ask:
   a. Did the students realize the inaccuracies of this method?
   b. What did the students do with the data after it was computed?

III. Equipment

A still camera and plenty of film are the only required materials.

IV. Procedure

Be familiar with the Peterson Population Estimation technique, Chap. II, Sec. 1. On two different dog walks take a photo of every dog seen.

Using the formula below, calculate the population.

$$P = \frac{M(U + R)}{R}$$

P - Population.

M - Photographed Walk #1.

U - Photographed Walk #2, not in Walk #1.

R - Rephotographed (Walks #1 and #2).

V. Limitations

The cost of film and processing should be the only drawback.

VI. Past Studies

Students at George School use this method for finding fish populations, except that instead of photographing they clip the fins when fish are caught in a large net.

Biologists use this method frequently whether they use photography, tagging, fin clipping or whatever as the method for marking.

A graduate student at Johns Hopkins University in Baltimore, Maryland, used this method and others and in connection with the state veterinarian estimated the pup-population of Baltimore at 100,000!

VII. Bibliography

Beck, Alan M., "The Life and Times ...," See Ch. 1, Sec. 4, A.

Do Cities Really Need Dogs, See Ch. 1, Sec. 4, B/

"Dog Fight", See Ch. 1, Sec. 4, B.

Holmes, C. R., "Let's Defuse Dog-dom's Population Explosion", See Ch. 1, Sec. 4, B.

Klopfer, Peter, H., Behavioral Aspects of Ecology, See Ch. 1, Sec. 4, B.

Schoenstein, Ralph, "What Even Your Best Friend", See Ch. 1, Sec. 4, B.

Section 3, C

Dog Food

I. Introduction

This is a survey type transitional activity that can really get the community involved in both the dog and rat problems. This is good for fifth graders and up and should take anywhere from two hours to two weeks depending on whether or not community involvement is your goal. No equipment is required unless advanced students (high school) plan to do stomach content or feces analysis.

II. Questions

1. Questions to lead into the activity:
   a. Why is one dog fat and one thin?
   b. How much do dogs weigh?
   c. Why does this amount vary?
2. Questions to initiate the activity:
   a. What do dogs eat?
   b. Do all dogs eat the same thing?
   c. Why do different dogs eat different things?
3. Questions to continue the activity:
   a. Where do feral dogs get food?
   b. Do people feed them? Directly? Indirectly?
   c. What do you do with your garbage?
   d. Is it dog or rat proof?
   e. Do you ever have to clean it up after it's been knocked over?
   f. What's left?
4. Questions to expand the activity:
   a. How does the garbage pick up system relate to how dogs eat?

b. How can we cut down on the dog and rat problem by food?

c. How can we find out what a dog or rat has eaten?

5. Questions to evaluate the activity:

a. Did students see how dogs feed rats?

b. Do students now see how they contribute to the dog and rat problem?

III. Equipment

If advanced students want to do stomach content or feces analysis of either dog or rat, basic dissecting tools plus a microscope are needed. If this is not being done, there are no equipment requirements.

IV. Procedure

Have the students observe dogs feeding and then examine the "kill" to determine what has been eaten. Students could organize a community clean-up campaign to lessen the food availability. Advanced students could analyze the stomach content or feces of dog or rat to determine what has been eaten.

V. Limitations

None are seen except in the advanced level where stomach content and feces analyses could present a health hazard to those doing it.

VI. Past Studies

A graduate student at Johns Hopkins University in Baltimore, Maryland, observed the feeding habits of the dogs he was studying for his thesis.

VII. Bibliography

Beck, Alan M., "The Life and Times ...", See Ch. 1, Sec. 4, A.

Frame, George W., "Wild Dogs of Africa", Science Digest, New York, New York, June, 1970, pp. 33 through 38. A good article of how wild dogs (in packs) behave in an undisturbed environment.

Klopfer, Peter H., Behavioral Aspects of Ecology, See Ch. 1, Sec. 4, B.

Schaller, George B., "Predators of the Serengeti: Part 2", See Ch. 1, Sec. 4, E.

Section 3, D

Territorial Imperatives

(Adapted from Robert Ardrey's Book, "The Territorial Imperative")

I. Introduction

This transitional activity shows that certain ecological concepts are basic when an urban or natural system is used. In this case the relationship of territory to dogs and people is best explored by grades seven and up during a dog walk and in the post-walk talk.

II. Questions

1. To lead into the activity ask:
   a. Do you have a "special place"?
   b. What happens if someone is in your "special place"?
2. To initiate the activity ask:
   a. Where does the dog live?
   b. Where does he get his food? His water?
3. To continue the activity ask:
   a. How far from home does he go?
   b. What is his "home range"?
   c. Why does he go that far?
4. To expand the activity ask:
   a. Why doesn't he go further?
   b. Where do other dogs go?
   c. Why do they go where they go?
5. To evaluate the activity ask:
   a. Were the students able to figure out the home range? How?
   b. What environmental factors did they correlate with the dog's home range?

III. Equipment

Detailed maps such as topographical maps are the only equipment not normally found in a home or classroom.

IV. Procedure

Have the students follow several dogs, plotting all sightings on a map Connecting outermost points (using home as center),determine the home range. Map out territories of the dogs. Add such things as food and water sources, shelter, many people, etc.

V. Limitations

The only hazards are those present when normally working with feral dogs. See this section in the "approachability" activity.

VI. Past Studies

A graduate student at Johns Hopkins University in Baltimore, Maryland, made a study of dogs and their territories for his thesis.

VII. Bibliography

Ardrey, Robert, The Territorial Imperatives, See Ch. 1, Sec. 4, B.

Beck, Alan M., "The Life and Times ...,"See Ch. 1, Sec. 4, A.

Frame, George W., "Wild Dogs of Africa", See Ch. 2, Sec. 3, C.

Klopfer, Peter H., Behavioral Aspects of Ecology, See Ch. 1, Sec. 4, B.

Schaller, George B., Predators of the Serenget: Part 2, See Ch. 1, Sec. 4, E.

CHAPTER III

Chapter III contains "Operational Activities" on birds and weather. Both studies are reports from Burgundy Farm Country Day School Wildlife Camp in Cooper's Cove, West Virginia, directed by John Trott, conducted by students, and authored by students from the Wildlife Camp and Project KARE.

The major limitation to one aspect of the bird study is that a banding permit is required, and this is not readily available. But the work can be done in conjunction with a banding station in your locale, or by students who are qualified.

For example, Jim Shiflett and Win Coffin, both Wildlife Camp graduates, spent two months with Beachwood and University School students outside Cleveland, Ohio, in the spring of 1972. Jim operated a banding station. In 1973 he was hired by University School and the Shaker Lakes Nature Center to continue his studies while involving many other school children. Many of the activities in this book were originated by Jim. Win returned to college. A classmate of theirs, Holly Wagner,is now the nature specialist at the Audubon Nature Center in Montgomery County, Maryland.

Other resource persons are in your neighborhood. They can help by working with your students during "awareness" and "transitional" phases, preparing them to conduct "operational" activities later on.

Section 1

Bird Studies

I. Introduction

Man has long been fascinated by the only living creatures that fly. Observing, photographing, drawing, banding, recording, hunting, and listening to birds have long been favorite pastimes. Man's attempts to imitate and his need for food have led him to study and hunt birds. In his ignorance of bird behavior he has often simultaneously endangered the survival of the very creature he seeks to enjoy.

There are, however, many who love birds, not as food or for sport, but as a unique and irreplaceable part of the delicately interwoven systems of nature. These people are the bird watchers and researchers who seek birds for their beauty and work to preserve their existence and wildness. There are many institutions and thousands of individuals participating daily in an active appreciation of birds.

There are many activities and studies, projects and programs available to the bird lover at any level of interest, skill, and intensity. The studies described here are those conducted each summer at Cooper's Cove, West Virginia, near Capon Bridge at the Burgundy Wildlife Camp. Here the staff and campers daily investigate birds, recording sightings, finding nests, banding birds, and completing individually designed projects relating to bird life. All these activities are aimed at developing in campers a greater awareness of, and appreciation for, the world of birds in Cooper's Cove. The rest of the bird world (outside Cooper's Cove) is revealed through numerous books, occasional nestings of migrating birds, staff and camper experiences, bird

photographs, movies and guest specialists. That campers achieve the goal of a better knowledge, and understanding of the appearance, habits and songs of birds is evidenced most clearly in the campers' enthusiasm and familiarity with birds in the area. This is reflected in a questionnaire given to experienced campers during the summer of 1972. Typical comments contained references to the wonderful feeling of interaction with and appreciation of nature deriving from the ability to walk through an area and know the birds around by song, flight pattern, sight and nesting evidences.

Generally the Burgundy campers acquire a ready knowledge of the birds found in Cooper's Cove and a sympathetic understanding of the place that birds occupy in the total ecological tapestry that forms their surroundings. The attitude this knowledge generates, and its actual application, are necessary in the preservation and, in some cases, restoration of bird populations. This general attitude, with its mandate for action, are the implicit result of any true study of birds. A true study consists of a sincere attempt to observe, identify, and learn about birds. These studies take many forms and each has a valuable use.

Reports of nest finds, lists of species sighted, and numbers of birds banded, if recorded and compiled, can be useful in an amazing number of ways. There are many national studies of birds banded and nests found to determine population densities, migratory behavior, etc., and how each of these relates to the local and national environment. This relation is studied in relation to other environmental influences (food, nesting area availability and predator population, etc.). All banding data is first reported to the Fish and Wildlife Service (that department which issues the necessarily prerequisite banding

licenses). The other sorts of data are used by individuals, speculating on trends and fluctuations, establishing patterns, and explaining accidents. All of these represent only beginnings of uses for figures collected. The projects and ideas evolving from the records are interesting to the individual bird lover, useful to the institutions studying larger areas, and perhaps most important, symbolic of the true interest in ornithology and the initial impetus for local, regional, national or international action to promote wildlife management and conservation in direct relation to birds and indirectly all animals and their natural environment. The most important element of wildlife management in general is the education of people to the wise management of their own activities. Thus the bird watcher, the bander, and all the researchers are those who will ultimately assume responsibility for the actual preservation of wildlife love.

II. Materials and Methods

A. For General Bird Studies; Field Observation

1. A pair of binoculars is a must especially for beginners. These should be used after having sighted a bird that you wish to examine with the naked eye. Without losing sight of the bird, raise the field glasses to your eyes magnifying the already spotted bird for observation and identification.

2. A good field guide to birds. This, of course, is a book that contains at least the most common local species with pictures of ♀ and ♂ and varying notes including information like dimensions, verbal description of bird song, nesting and breeding source, map of habitation, description or picture of bird during flight, etc. (See Bibliography for several famous guides.)

3. A bird list to mark down the birds seen. These are often found in the back of a field guide, but marking these limits their use when they are copied.

4. For extended study of a nest or particularly fruitful birding spot, a blind is an excellent device. It is of utmost use for photography of nesting birds. This can be a natural cover or a spot constructed out of nearby branches, etc., however, a portable and effective blind can be made from a wood microstructure (about the size and shape of the lower 3/4 of a telephone booth)covered with burlap. A small stool inside and an appropriate viewhole properly placed will provide the observer with a comfortable, convenient viewpoint.

5. A chart, notebook or file of lists to record results of bird trips. The photographer who attempts to capture birds on film will, of course, need film, camera, and other equipment depending on desired sophistication of photographs, experience, and funds. The most valuable aids available to the camera operator are the many photographic books and journals, experienced advice, and persistence.

6. A viewing device is of utmost use in nest identification. This is a piece of equipment, often handmade, that consists of a long pole (6-8 feet) with a mirror (at least 2" x 2") attached to the top at an obtuse angle. This will enable the normally well grounded homo sapiens to peer into a nest without damaging or disturbing it or removing it from its position in a tree.

7. Exceptionally useful in all studies are the Audubon Society's identification charts of birds, arranged in philogenetic order. These are called the Audubon Land Bird Guide Rapid Recognition Sheets, Doubleday, Inc., 1963. Available for local birds. An excellent companion to the book of the same name.

B. Equipment Necessary for Bird Banding

1. A bird banding license only dispensed from the U. S. Fish and Wildlife Service, and very difficult to obtain. THIS IS NECESSARY FOR ANY BIRD BANDING OPERATION.
2. Bird bands (supply free with license).
3. Nets or traps that may be purchased from a number of bird banding associations. These, of course, are used to trap the birds to band or recover previously banded birds.
4. Pliers and tools available again from bird banding associations. These are used to put bands on birds.
5. Carrying cases for birds from nets or traps to banding station. These too can be purchased from bird banding associations.
6. Notebooks or other recording and filing system (easily made if standard charts are drawn up and lettered).
7. Scale to weigh birds. A net can be used to hold the bird and the scale adjusted to compensate for the weight of the net.
8. A thermometer to record temperatures at time of banding or other instruments to compile desired statistics for study.
9. A station or headquarters for banding and processing the birds. A tent allows convenient location, light, dry equipment, and a soft walled cage for birds that might escape.

In a bird banding operation the most difficult problem presented is finding a way to capture birds safely and economically. The use of mist nets has proven to be the best method. The mist nets, which are made of fine black nylon, manage to capture birds that fly into them with a minimum of casualties. The majority of casualties result from improper handling by the bander in removing birds from the nets or from overexposure.

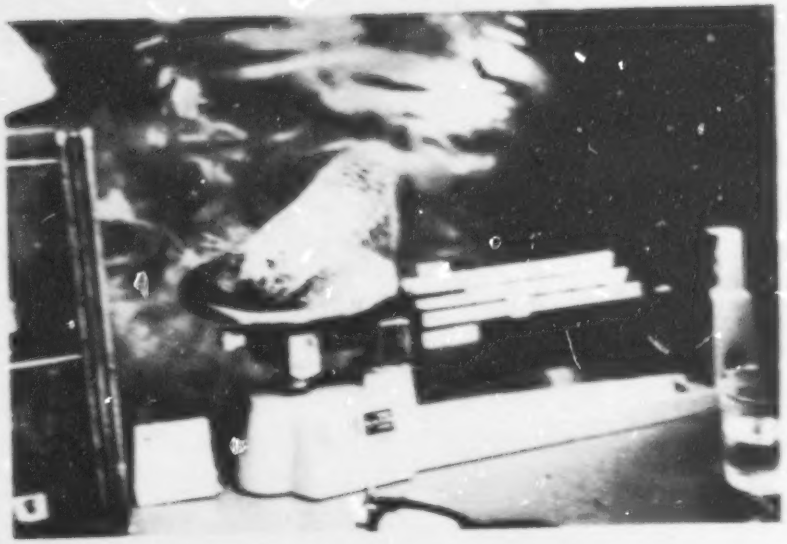
The nets used at Burgundy Wildlife Camp were placed across expected flying paths of the birds. These paths included the area around the creek where the birds would come in to bathe and drink.

The bander will open his nets during the day and check them in 15 to 60 minute intervals, depending upon the severity of the weather. If a bird has been netted, the bander carefully removes it from the net and places it in a carrying case. After retrieving all captured birds,the bander returns to the banding tent where all of the vital statistics are recorded. At the tent the bird will be identified, measured, weighed, aged by means of skull ossification or plumage, and sexed by plumage, evidence of brood spot, mouth color or wing measurement. After this the bird is banded and released. The total amount of time the bird was held in captivity should never exceed one hour.

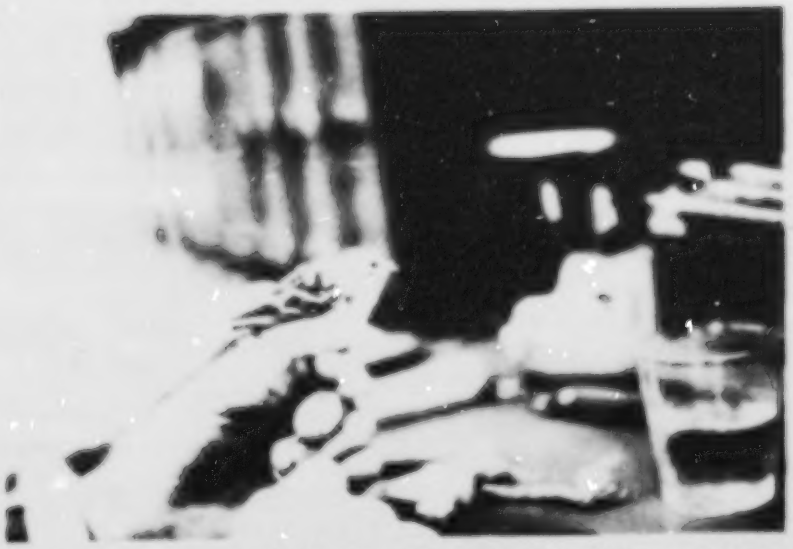
On the morning of a banding day the nets are opened by staff member Michael Sutton and camper Paul Burdick.

Here a bird is carefully being freed from a mist net. Once free it can be identified as a Virginia Creeper.

Once the bird is inside the banding tent its wing is measured.



Wrapped in plastic netting, the bird is weighed.



This bird is ready to be released with its new band.

This brief summary of a banding operation should help to show the extent of training a bander must have in order to run a banding station.

III. Data, and

IV. Interpretation

A. Bird Observation Studies

The least expensive and often most productive way of doing a bird study is through simple observation. Meaningful and reliable data is collected with few materials needed. The most valuable piece of equipment needed is an acute awareness of the surroundings. The observation studies at Burgundy Wildlife Camp took the forms of a bird population study by sightings and a nest finding study. These studies provided the camp with a list of species predominant to the area and also species that are comparatively rare. The nest study, which took the form of a contest at the camp, provides information that was forwarded to the Cornell Laboratory of Ornithology for analysis.

Keen observation is the key to any study, expecially bird watching. Here several campers attempt to locate the source of a call they just heard.

In order to implement a bird population study comparable to that of the Wildlife Camp it is necessary to have forty observant and ornithologically oriented campers and staff who spend most of the day out of doors. Each day a camper is selected to keep the bird list. He is then given a simple two-page checklist of birds of the area. The list used was created by the Audubon Naturalist Society of the Central Atlantic States, Inc. (See Figure 1). The campers then go through their normal daily routine and make careful mental notes of the location and species of birds they observe. Sometime in the afternoon the campers meet with the person who has the bird list and tell him the species and location of birds that were sighted that day. That evening the list is compiled and transferred onto a chart in the dining room at the camp. The chart included the species, location sighted, date sighted and number sighted.

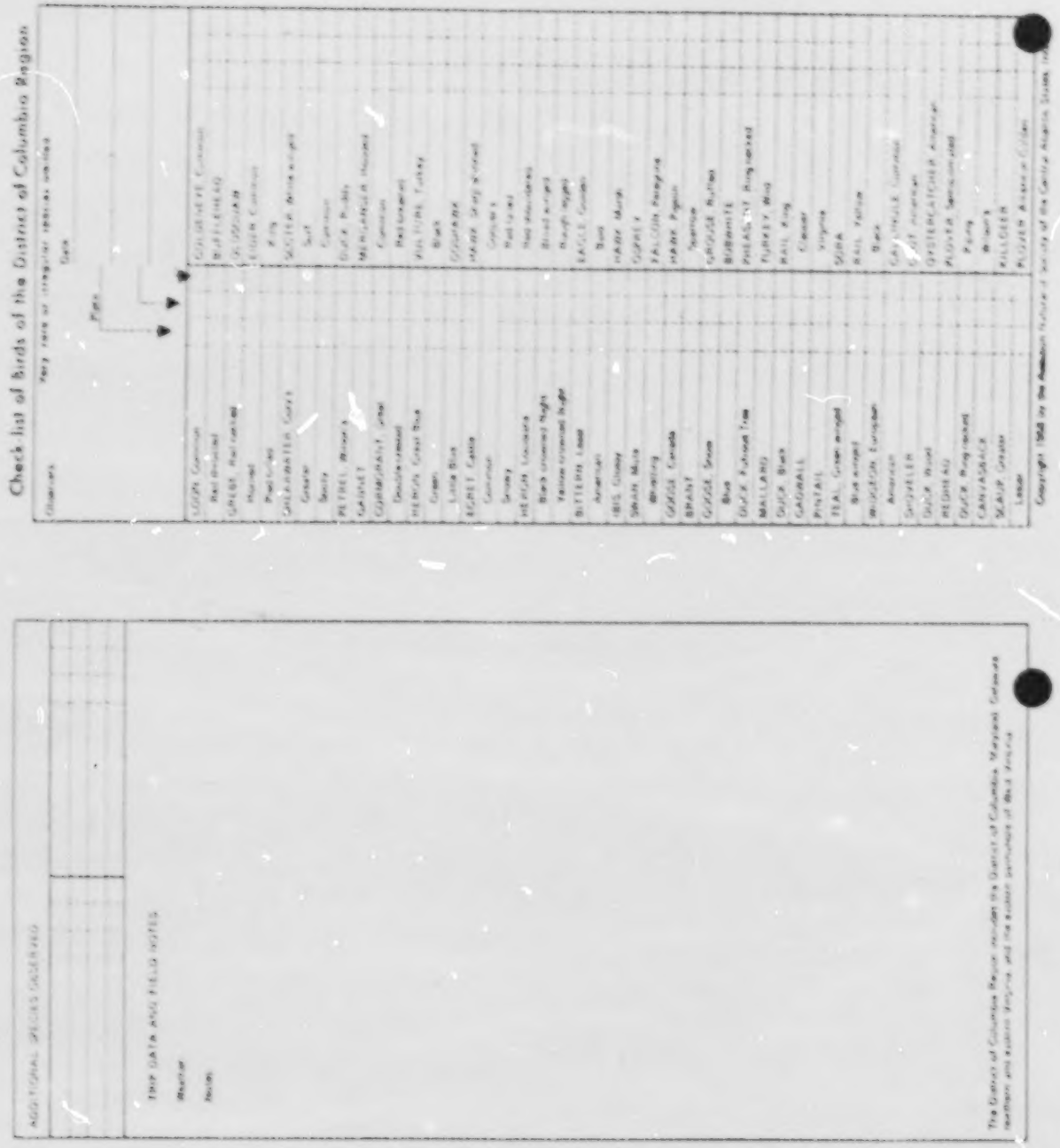

Check list of Birds of the District of Columbia Region
Observers
Date
Place
Key: rare or irregular species, winter
ADDITIONAL SPECIES OBSERVED
TRIP DATA AND FIELD NOTES
Route
Note
The District of Columbia Region includes the District of Columbia, Maryland, Delaware, northern and eastern Virginia, and the eastern panhandle of West Virginia

Figure 1

Bird Sighting Checklist

Figure I (Continued)

BIRDS SIGHTED AT WILDLIFE CAMP 1970

SPECIES	NUMBER OF DAYS SIGHTED FROM				
	6/21 TO 7/1	7/2 TO 7/11	7/12 TO 7/21	7/22 TO 7/31	TOTAL
Green Heron	0	0	1	0	1
Wood Duck	0	0	1	0	1
Turkey Vulture	10	10	10	10	40
Black Vulture	7	8	7	1	23
Cooper's Hawk	2	0	1	1	4
Red-tailed Hawk	5	9	9	10	33
Broad-winged Hawk	1	5	7	7	20
Peregrine Falcon	0	0	2	0	2
Slarrow Hawk	0	0	4	3	7
Ruffed Grouse	7	7	2	7	23
Bobwhite	10	10	10	9	39
Killdeer	6	2	9	7	24
American Woodcock	1	2	0	0	3
Spotted Sandpiper	6	10	0	0	16
Solitary Sandpiper	0	0	0	1	1
Greater Yellowlegs	0	0	0	1	1
Mourning Dove	10	7	8	8	33
Yellow-billed Cuckoo	10	10	7	0	27
Black-billed Cuckoo	9	2	0	0	11
Screech Owl	-	-	4	8	12
Barred Owl	0	1	0	1	2
Whip-poor-will	10	10	10	5	35
Chimney Swift	8	10	10	10	38
Ruby-throated Hu-mingbird	7	9	7	9	32
Belted Kingfisher	3	8	7	6	24
Yellow-shafter Flicker	10	10	9	10	39
Pileated Woodpecker	10	9	10	9	38
Red-bellied Woodpecker	3	10	4	8	25
Hairy Woodpecker	9	8	10	6	33
Downy Woodpecker	12	10	10	10	40
Eastern Kingbird	10	10	10	10	40
Great-crested Flycatcher	10	9	0	1	20
Eastern Phoebe	10	10	10	10	40
Acadian Flycatcher	10	10	10	7	37
Trail's Flycatcher	0	0	0	1	1
Eastern Wood Pewee	10	10	10	10	40
Horned Lark	0	0	0	1	1
Tree Swallow	1	0	1	1	3
Rough-winged Swallow	0	0	4	4	8
Barn Swallow	7	6	10	10	33

Figure 2

BIRDS SIGHTED AT WILDLIFE CAMP 1970

Blue Jay	9	6	10	10	35
Common Raven	0	0	1	2	3
Common Crow	10	10	10	10	40
Black-capped Chickadee	7	9	3	7	26
Carolina Chickadee	8	0	2	6	16
Tufted Titmouse	10	10	10	10	40
White-breasted Nuthatch	9	9	5	8	31
House Wren	2	1	0	0	3
Mockingbird	5	8	6	5	24
Catbird	7	10	10	9	36
Brown Thrasher	10	10	10	10	40
Robin	10	10	10	10	40
Wood Thrush	10	10	10	10	40
Eastern Bluebird	10	10	10	10	40
Blue-grey Gnatcatcher	8	6	4	5	23
Cedar Waxwing	2	2	0	5	9
Loggerhead Shrike	5	0	5	8	18
Starling	5	1	2	0	8
Yellow-throated Vireo	6	2	2	0	10
Red-eyed Vireo	10	10	9	10	39
Black-and-White Warbler	2	0	0	2	4
Worm-eating Warbler	9	6	1	4	20
Golden-winged Warbler	6	6	3	7	22
Yellow Warbler	1	0	1	0	2
Black-throated Green Warbler	0	1	0	0	1
Cerulean Warbler	10	9	8	8	35
Pine Warbler	2	0	0	0	2
Prairie Warbler	0	0	1	0	1
Ovenbird	5	3	1	0	9
Louisiana Waterthrush	6	9	8	10	33
Kentucky Warbler	9	2	1	0	12
Yellowthroat	10	10	10	10	40
Yellow-breasted Chat	10	10	9	6	35
Hooded Warbler	6	5	0	2	13
American Redstart	3	3	1	4	11
Eastern Meadowlark	10	10	10	10	40
Red-winged Blackbird	0	0	5	4	9
Orchard Oriole	9	9	2	0	20
Baltimore Oriole	10	10	7	10	37
Common Grackle	7	9	0	5	21
Brown-headed Cowbird	10	10	9	10	39
Scarlet Tanager	10	10	10	6	36

Figure 2 (Continued)

BIRDS SIGHTED AT WILDLIFE CAMP 1970

					39
	10	10	9	10	40
Cardinal	10	10	10	10	40
Indigo Bunting	10	10	10	10	40
American Goldfinch	10	10	10	1	1
Rufous-sided Tohee	0	0	0	10	40
Grasshopper Sparrow	10	10	10	10	40
Chipping Sparrow	10	10	6	4	15
Field Sparrow	0	5			
Song Sparrow					

TOTAL SPECIES 91

Figure 2 (Continued)

In 1970 the record of bird populations was kept by recording the number of days a species was sighted over the forty day period the camp was in session. (See Figure 2.) The data collected was then used by several campers in creating a checklist of birds of the immediate area. The project printed here was done by Fred Hirschman, then a camper at the Wildlife Camp. The checklist includes the birds that nest in the area, the possibility of a sighting and a description of previous sightings of each species known to the area.

Keen observation is necessary for participation in the nest study. The study involves the location of active nests, that is, nests in use, and

Birdhouses like this one bring nests into the locality of the camp.

the collection of certain data about the nests. At the camp the study was in the form of a contest. Each nest sighted constituted a certain

number of points, depending upon the rarity of the nest in the area and the number of eggs or young inhabiting the nest. Other data collected on each nest includes species, common name of plant supporting nest, height of nest, date found, and location by grid map. These data are placed on a simple data sheet and returned to the staff member in charge of this project. (See Figure 4.) The results of the findings are then recorded on record cards that are forwarded to the North American Nest Record Card Program at Cornell University. In correspondence with Edith Edgerton of the program, we obtained literature discussing the value and application of the nest record cards which are collected nationwide. Through the sightings the Laboratory of Ornithology at Cornell is able to tell peaks in breeding seasons, regional breeding distribution and variations of seasons, nest sizes, etc. The program, although it started in 1965, now receives over 20,000 records from more than 900 contributors. Further information, including how to become a contributor, can be obtained by writing North American Nest Record Card Program, Cornell Laboratory of Ornithology, 159 Sapsucker Woods Road, Ithaca, New York 14850.

The staff member at Wildlife Camp also displays the data concerning the nest obtained by the camper. Points are awarded to the sightings based upon the rarity of the species and the number of eggs in the nest. (See Figure 5.)

NEST FINDING CONTEST

SPECIES _____

COMMON NAME OF PLANT SUPPORTING NEST _____

LOCATION _____

HEIGHT OF NEST _____

CONTENT _____

GRID IN WHICH NEST IS LOCATED
(ON MAP IN DINING ROOM) _____

FINDER (YOUR NAME) _____

Complete and place in Mike Sutton's Mailbox.

Figure 4

NEST FINDING CONTEST

Species	Nest Support	Location	Height	Content	Date	Grid	Finder	Points
Chipping Sparrow	Virginia Pine	Field below Sheep Barn	8 ft.	2 eggs	07-09-72	28	David Abbott	17
Cardinal	Blackberry Bush	Across Road Near Lodge	5 ft.	2 eggs	07-10-72	20	Joan Chaitern	22
Chipping Sparrow	Red Cedar	Far Field	4 ft.	4 young	07-12-72	-	John Gurn	27
Mocking Bird	Red Cedar	Far Field	5.5 ft.	3 eggs	07-15-72	-	John Gurn	23
Chipping Sparrow	Red Cedar	Near Pond	4 ft.	3 young	07-15-72	30	John Gurn	24
Eastern Bluebird	Nest Box	Near Chicken Coop	6 ft.	2 young	07-22-72	28	Peter Pyle	21
Rufas-sided Tohee	Redbud Tree	100 yds. past Green bus	5 ft.	2 young	07-24-72	-	Nate Erwin	26
Intigo Bunting	Common Thistle	Far Field	1.5 ft.	4 young	07-28-72	-	Peter Pyle	37
Indigo Bunting	White Ash	Road to Fire Tower	4 ft.	3 eggs	07-28-72	-	Steve Holt	28
Yellow-billed Cuckoo	Black Locust	Road to Bald	1.5 ft.	3 eggs	08-01-72	-	Peter Pyle	28

Figure 5

At the end of a session at the camp the camper with the most points is awarded for his observations.

B. Banding Operations

There are any number of equally valid ways of keeping records on a banding operation. Burgundy Wildlife Camp has used a system of data filing that has proved easy to compile and store for future analysis. This system involves the use of only three different mimeographed sheets for the recording of all records. From those sheets, which record the daily banding record, the birds banded that day, and the birds recovered that day that had been previously banded, a multitude of analyses can be made. Among the analyses possible are a representative population survey of birds netted most often, the growth patterns of netted birds, and the net hours required to net a particular species of bird.

At the beginning of each banding day, a daily banding record sheet is started. The first section of the sheet is divided into three sections. This sheet includes date, minimum temperature, maximum temperature, a space for writing weather conditions and time of sunrise and sunset. The next section has spaces for figuring the net hours, which is found by multiplying the number of nets in operation by the number of hours that they were open. There is space for recording the location of the nets and the times of opening and closing. The third section of the record sheet is for recording total nets used, total net hours, total individuals banded, total species banded, recoveries and total birds netted on that day. (See Figure 6.)

When an unbanded bird has been caught, data on that bird are recorded in a notebook divided by band size. The bander will turn to the band size necessary for the bird and record on the banding sheet the total number, species, AOU (philogenetics) number, age, sex, wing length, weight, location

of capture, time of capture, date, current temperature, number of location by the camp grid, and comments, such as molting or breed spot. Usually over ten birds have data recorded on one of these sheets. (See Figure 7.)

If the bird netted has been banded before,the bander will refer to a different notebook on recoveries of the current year. At this point the bird will be placed under one of three designations - repeat, return, or foreign retrap. A repeat designation means that the bird was banded during that banding season and has not migrated since then. This bird is often in its first year. A return bird is one that was banded in a previous season and has migrated and then returned to the area. This bird will always be older than one year. The majority of the birds recovered will be either repeats or returns. A rare occurrence will be the capturing of a bird banded at some other banding station. This is a foreign retrap. Very rarely will birds travel out of their migration paths and stop near a banding station. At Burgundy Wildlife Camp during a banding season in which about 200 birds are captured there might be one foreign retrap among those birds.

Also recorded on the recovery sheet is the species, band number, and original date banded. There are also about fifteen spaces on the sheet to record the date, time, location, age, sex, status, wing measurement, weight, temperature and weather conditions every time the bird is recovered. (See Figure 8.)

After several years various comparisons can be made as a result of the records kept on the banding. An example of one of the many possible studies is a total population comparison of various species over a period of several

BURGUNDY WILDLIFE CAMP DAILY BANDING RECORD

Date _____ Temperature: Min. _____ Max. _____

Weather (Sky, Temp., Wind, Precip., Etc.):

_____

_____

_____

Sunrise _____ Sunset _____ NETS IN OPERATION

NETS		Location	Number
Set _____	at _____	_____	_____
Closed at _____	Net hrs. _____	_____	_____
Set _____	at _____	_____	_____
Closed at _____	Net hrs. _____	_____	_____
Set _____	at _____	_____	_____
Closed at _____	Net hrs. _____	_____	_____

Total nets used _____

Total net hours _____

Total individuals banded _____

Total species banded _____

Recoveries: Repeats _____ Returns _____ Foreign _____ Total _____

Total birds netted _____

Comments _____

_____

_____

Figure 6

BAND SIZE _____ BAND PREFIX _____ PAGE _____

BAND NUMBER	SPECIES	ACRU	STAT	AGE	SEX	WING	WEIGHT	LOC	TIME	DATE	TEMP	GRID	COMMENTS

REV:8:1

104

Draft

Figure 7

RECOVERIES

REPEAT _____ RETURN _____ FOREIGN RETRAP _____

SPECIES _____ BAND NUMBER _____

ORIGINAL DATE BANDED _____

DATE	TIME	LOC	AGE	SEX	STAT	WING	WEIGHT	TEMP	WEATHER	COMMENTS

Figure 8

seasons or years. The total population of a species is figured by adding the total number of birds of that species banded that year to the total returns of that species for that year. In this study, ten bird populations were compared over a period of five years. (See Figures 9-13.) According to John Trott, the director of Burgundy Wildlife Camp and operator of the banding station, the net hours and dates over the five years were very consistent; therefore, the populations according to captures would be a reliable indicator of the total populations of the species studied. There is distinct evidence from these graphs that the American goldfinch, indigo bunting, yellow-breasted chat, field sparrow and chipping sparrow follow directly proportional population curves and represent predominantly decreasing populations. The wood thrush, tufted titmouse, rufous-sided tohee, and worm-eating warbler show, on the other hand, an inverse relationship to the first group of birds and a predominantly increasing population over the five year study. According to Mr. Trott, these relationships can be accounted for by the changing habitat of the camp. Over the five year period normal plant succession has been taking place in the meadow of the camp and the grassland habitat of the goldfinch, sparrows, chat,and indigo bunting is slowly being replaced by a succession forest. As a result of the increased foliage in these fields the forest dwellers, the wood thrush, titmouse, tohee and warbler have an increasing population in the area. The populations of these birds are directly dependent on the state of the environment.

In an effort to retain the habitat of the field dwellers, the director has the field mowed in the fall on alternate years.

Another factor that affects bird population relations is inter-species competition. This usually is found when several closely related birds, such as

Bird Studies

TOTAL POPULATION DATA SHEET

	1968			1969			1970			1971			1972		
	Banded	Total	Returned	Banded	Total	Returned	Banded	Total	Returned	Banded	Total	Returned	Banded	Total	Returned
American Goldfinch	123	155	32	90	101	11	177	233	56	114	154	40	16	24	8
Wood Thrush	13	13	-	28	32	4	21	30	9	33	46	13	35	47	12
Chipping Sparrow	21	29	8	22	22	-	46	62	16	13	16	3	8	12	4
Field Sparrow	33	37	4	26	29	3	21	24	3	19	25	6	11	19	8
Tufted Titmouse	7	10	3	17	18	1	7	7	-	5	9	4	8	9	1
Refous-sided Tohee	6	6	-		8 10		2	9	2		- 13		11	13	2
Worm-eating Worbler	4	4	-	14	14	-	6	7	1	22	26	4	10	14	4
Yellow-Breasted Chat	12	16	4	10	16	6	13	18	5	8	10	2	5	8	3
Indigo Bunting	19	23	4	17	20	3	20	26	6	10	13	3	6	14	8

Figure 9

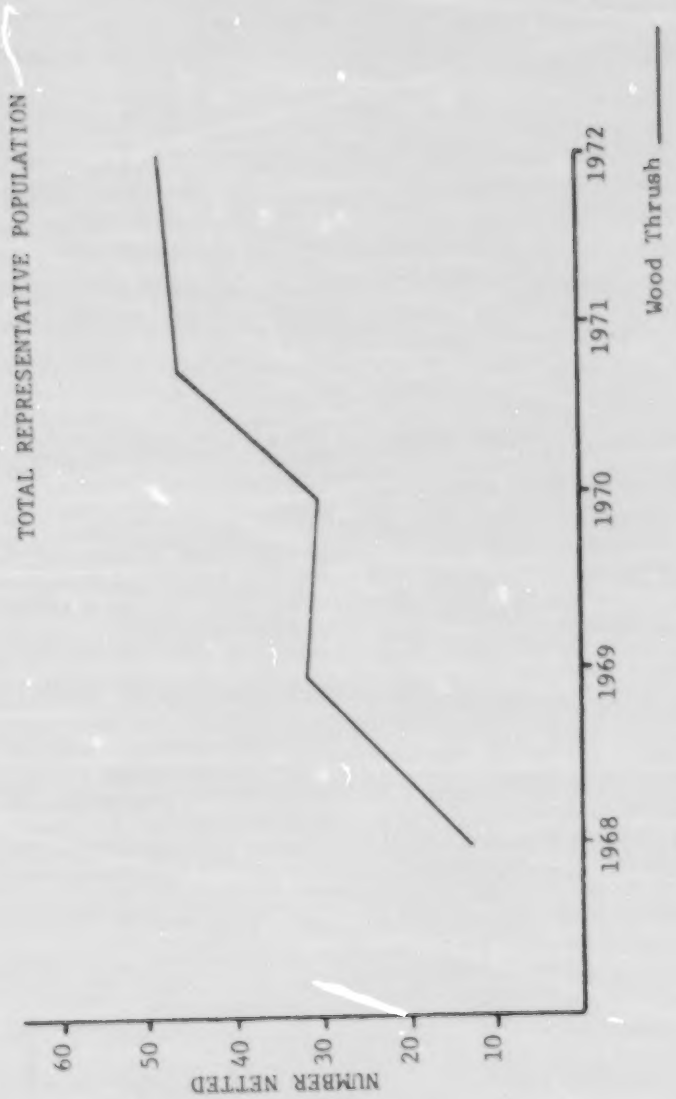

TOTAL REPRESENTATIVE POPULATION
NUMBER NETTED
60
50
40
30
20
10
1968
1969
1970
1971
1972
Wood Thrush

Figure 10

TOTAL REPRESENTATIVE POPULATION
NUMBER NETTED
240
200
160
120
80
40
1968
1969
1970
1971
1972
American Goldfinch

Figure 11

TOTAL REPRESENTATIVE POPULATION BY CAPTURES

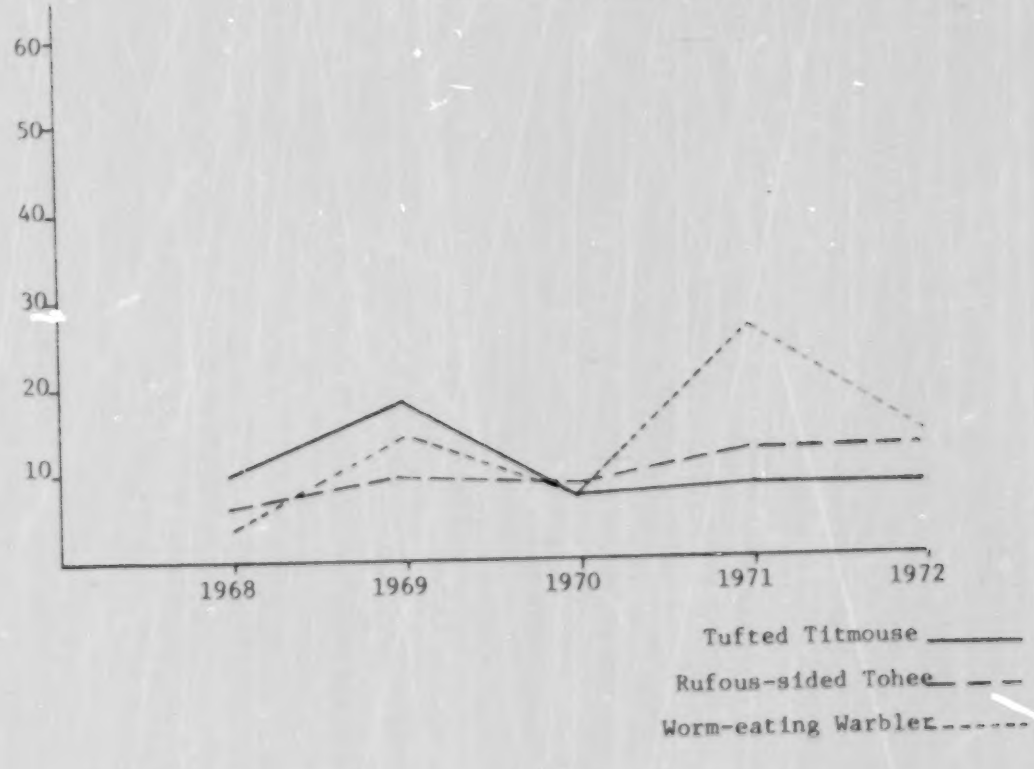


Figure 12

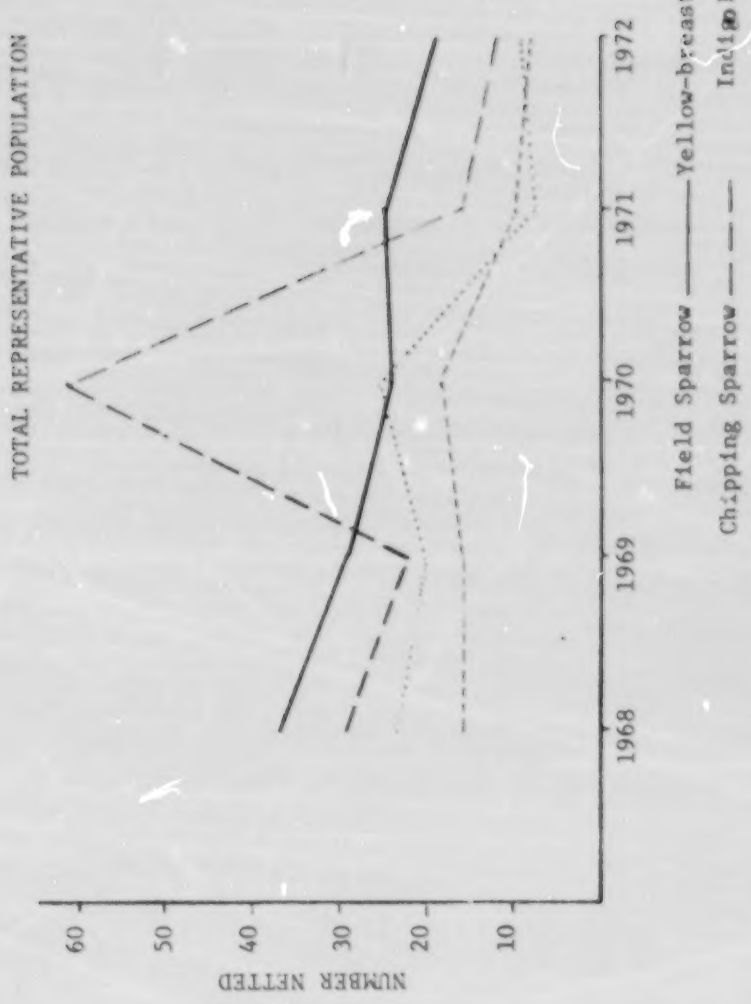

TOTAL REPRESENTATIVE POPULATION
NUMBER NETTED
60
50
40
30
20
10
1968
1969
1970
1971
1972
Field Sparrow ——— Yellow-breasted Chat .....
Chipping Sparrow — — —
Indigo Bunting .....

Figure 13

erhaps the greatest re-
ard of bird banding is
ne close contact with
ne captured birds.
ere are a few results
f a banding day: a
uby-crowned kinglet
top left), a common
lue jay (middle), and
nuthatch (bottom).

the mockingbird, catbird, and brown thrasher come together in a similar habitat. These birds will be in direct competition. The result is generally the domination of one species' population over the other two. The three wrens of the area, the house wren, Bewick's wren, and Carolina wren, will also be found to compete. Natural phenomena can also greatly affect the populations of birds. These events can range from destructive, i.e., drought, forest fire, famine, to beneficial, i.e., extremely good weather, abundant food. In 1970 the emergence of the seventeen year chicada took place. It had two effects on the bird populations. Upon emerging, the chicada created an enormous food supply. This attracted insect feeders to the area in large groups. Any bird that was large in size and adapted to insects thrived during 1970.

The second effect of the locust was on the breeding habits of the birds. According to Mr. Trott, the din created by the locusts might have been confused with the territorial songs of the breeding birds. This caused a decrease in mating that year, though the full impact of fewer offspring shows in 1971.

V Conclusions

The art of observing possibly becomes more fully developed in bird watchers than scientists and observers in other fields. The observation studies use practically no materials beyond the observer himself, yet a multitude of in-depth, reliable data is obtained. Data from observation is placed on file in the camp for future use including comparison of bird populations from year to year. The habits of birds, when observed and recorded, can be used as indices of environmental change.

The important element in any bird observation studies is that, with some training, everyone can participate. The study does not have to be made for a

nationwide survey such as the Nest Record Card Program. A local project will increase total environmental awareness as more people study life outside the classroom.

In order to follow the results of the banding operations, we wrote to the U.S. Fish and Wildlife Service. From the Service we received information on the tabulation of nationwide banding operations and information on banding permits (Figure 14). More information can be obtained by writing U.S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, Laurel, Maryland 20810.

There is much that can be done with bird figures of the kinds one can collect. All banding data is reported to, and used by, the U.S. Fish and Wildlife Service to formulate and verify national trends. The nest finding data is sent to a national study being conducted at the Ornithology Department of Cornell University on bird nesting. Contributions to national studies are invaluable in bird research and have far reaching implications for national and international research organization. The BWC, therefore, sends the yearly results of its banding operations and nest finding contests to these respective studies. It is this kind of contribution, from a relatively active program that reports each year, that supports these larger studies most effectively.

Other uses for BWC statistics are the multi-variate camper projects that are required of each camper each 2-week session. Many campers choose to work with birds, and many use the extensive backlog of banding, sighting and nesting information. All sorts of possible correlations spring from such a wealth of data, and each one suggests a further study, only begun in two weeks. These projects are as different as the campers, naturally, and yet invariably interlock with the many other subjects investigated at the camp.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
Migratory Bird Populations Station
Laurel, Maryland 20810

WRes

August 15, 1972

In reply refer
to BLL-15

Mr. Pete Goldie
Project KARE
County Office Building
Route 73 and Butler Pike
Bluebell, Pennsylvania 19422

Dear Mr. Goldie:

I am writing in reply to your recent correspondence requesting information concerning the issuance of federal bird banding permits.

Most wild migratory birds throughout North America are protected by federal regulations. In order to capture these birds for the purpose of marking or banding, it is necessary to first obtain a Federal Bird Marking and Salvage Permit. Such permits are issued through this office.

The only purpose for banding such birds is the generation of complete, accurate, scientifically usable data. All such data accrued by professional and amateur banders throughout North America are forwarded to this office. This information is converted to magnetic computer tape and subsequently made available to scientists, wildlife technicians, students or banders who wish to make a detailed study of these birds.

For these reasons, persons who are issued permits are required to keep accurate detailed records pertaining to all birds they band. This requires not only many hours of paper work each year, but also a very sound background in ornithology and the ability to correctly identify the species, age, sex and various plumages of most of the birds they are likely to encounter.

At the present time, we are receiving many more requests from persons desiring permits than we are able to honor. We are, for this reason, only issuing permits to highly qualified individuals. We further request that these persons have a specific need for the banding technique.

In addition, all applicants must be at least 18 years old and be able to furnish the names of at least three licensed banders or recognized ornithologists who will vouch for the applicant's ability to correctly identify the birds he will likely be handling and his ability to maintain thorough, accurate, legible records.

Figure 14

TELEPHONE—AREA CODE 301 776-4880 (MARYLAND EXCHANGE)
TELEGRAMS—BUREAU OF SPORT FISHERIES AND WILDLIFE, WASHINGTON, D.C. 20240

Except in very rare instances, banding permits are not issued to persons holding propagating or taxidermy permits, and the banding of waterfowl is restricted to state and federal conservation agency employees or their assistants.

Special restrictions are placed on the banding of "endangered species" or Bald and Golden Eagles. We also place special restrictions on the use of mist nets, tranquilizing chemicals and color-marking techniques. If your research will require the use of any markers other than the standard, numbered leg bands, to sure to indicate this if you reply to this letter.

If you feel you can meet the qualifications outlined above, please notify me and I will forward the forms necessary to apply for a Federal Bird Marking and Salvage Permit.

In addition to your federal permit, most states require that you also obtain a state banding permit.

Sincerely yours,

George M. Jonkel

George M. Jonkel, Chief
Bird Banding Laboratory

Figure 14 (Continued)

A few of these are listed below. They can be grouped into two general classifications: those that are related to studies already completed (i.e., continued on same lines, expanding individual areas); those designed to explain inconsistent trends (i.e., accounting for population fluctuation by researching weather records). Another category, those which initiate a new type of study (i.e., measuring light intensity when a species of bird is caught) are suggested activities or types of studies that may be carried out in the future. These three categories are each expansive and are by no means complete.

In continuing further studies on these lines, campers have added criteria to banding records; attempted to capture and band an unusual bird unfit for mist nets used at a site; sat in a blind observing bird behavior. Director John Trott has even been able to take serious campers outside of this nation to study bird habits and species. Mr. Trott has written an article on such a trip which appeared in National Geographic's School Bulletin (April 17, 1972, Vol. 50, #27). During this trip to Tobago in South America, Mr. Trott taught his students in the winter home of North American birds.

From the basic studies made at Burgundy Wildlife Camp many new directions of investigation can come forth. One investigation can be relating the bird songs of the area to seasons, weather conditions and locations around the camp. From a song study investigations can be made into their significance and value to bird life. Another possible investigation might be the weight differences between birds caught in the morning and those caught at night.

The study of birds is by far the most important study made at Burgundy Wildlife Camp. Through such peaceful activities the campers gain insights

into their environment that far too few people ever realize. Perhaps the insights are received from love of the land or maybe they come from being in an environment where one is not taught, he learns.

VI. Bibliography

The following list of books and pamphlets were found useful in developing this study. It is suggested that teachers have on hand some of the more comprehensive sources for use in dealing with an in-depth bird study. This list is in no way complete and teachers are encouraged to make additions.

Altman, Philip L., and Dittmer, Dorothy S., Environmental Biology, Federation of American Societies for Experimental Biology, Bethesda, Maryland, 1966. A very highly technical data collection on 10 areas of environmental biological concern. This is a book "in which the effects of the environment (are) quantified for reference purposes." An excellent and extensive text of tables and charts. Not recommended for below 10th grade.

American Birds, 71st Christmas Bird Count (incorporating Audubon Field Notes), Vol. 25, No. 2, National Audubon Society and U. S. Fish and Wildlife Service, April, 1971. This book incorporates 903 bird counts made over Christmas 1970. Includes location, species, and individuals, compilers, etc. Good for population-oriented studies.

A.O.U. Checklist of North American Birds, 3rd Edition, A.O.U. Press of Edward W. Wheeler, Cambridge, Mass., 1895. A.O.U. listings of over 770 classifications of birds according to philogenetic order. The checklist is used by banders to determine the evolutionary scale of birds for classification. Use with Grade 9 and up.

Audubon Aids, Audubon Nature Bulletin, Educational Services, National Audubon Society, 1130 Fifth Avenue, New York, New York 10028. These

series of bulletins NB2 14 Teaching Aids, NB 3 14 Bulletins on Arrivals, NB6 7 on Conservation, NB7 9 on Ecology are excellent miscellaneous articles on the series subject by a veritable spectrum of writers. Catalog available by writing to National Audubon Society.

Bent, Arthur C., Life Histories of North American Birds, (In approximately 20 volumes), Dover Publications, New York, New York, 1960's. These volumes cover every North American species of bird in great detail, giving measurements, ranges, and other descriptions. Highly recommended research books.

Bird Banding, The Hows and Whys, U. S. Department of the Interior, U. S. Fish and Wildlife Service, Washington, D.C. 20240, January 1960. This is very good basic introductory material for bird banding. It is easily understood by grades 6 and up. The pamphlet outlines the purposes and methods behind bird banding.

Collins, Henry H., Jr., The Bird Watchers Quit Book, Harper and Bros., New York, N. Y. A humorous way to lear birds. Challenging.

Gray, Ralph, National Geographic School Bulletin, Vol. 50, Number 27, National Geographic Society, Dept. 162, 17th and M Streets, N. W., Washington, D. C. 20036, April 17, 1972. Excellent photographs and text of John Trott's trip to Tobago with some Burgundians.

Holland, W. J., The Moth Book, A Guide to the Moths of North America, Dover Publications, Inc., 180 Varick Street, New York, New York 10014, 1968. An extensive, complete, profusely illustrated bible of moths. Sections on how to capture, preserve and identify moths are included. An admirably complete listing of moths with intersprinkled quotations. Usable by anyone interested in moths.

Montgomery, F. H., Trees of the Northern U. S. and Canada, Frederick

Warne and Co., Inc., New York, N. Y., 1970. An excellent tree key for the specified area, good for most of the U. S. Includes key to both Tree Genera and Tree Species. Can be used effectively by grades 4-12.

Peterson, Roger T., A Field Guide to the Birds, Houghton Mifflin Co., Boston, Mass., 1947. A good field guide to the birds.

Reed, Chester A., North American Birds Eggs (Revised), Dover Publications, Inc., 180 Vanick Street, New York, New York 10014, 1965. Good guide to egg identification through description of egg of each species. 560 life-sized photographs of egg, plus drawings. This can be used with 6th graders

Robbins, Chandler S., Birds of North America, A Guide to Field Identification, Golden Press, New York, N. Y., 1966. The best (in my opinion) field guide to bird identification.

Trott, John and Wiggins, William, Summer Bird Population Studies in Catapon River Valley, (The Redstart), Vol. 35, No. 3, Brooks Bird Club, 707 Warwood Avenue, Wheeling, West Virginia, July 1968. This is John Trott's study of cold stream bird populations. This study was made in an area near Burgundy Wildlife Camp and it shows applications of bird banding and observation studies.

Section 2

Weather

I. Introduction

Local forecasts and weather conditions can be obtained from a nearby U.S. Weather Station or nightly from radio and TV, but actually investigating the meanings of various readings, recording weather conditions, and studying these multiple phenomena can be much more exciting and rewarding ways of following the weather. From a private weather station it is possible to observe the exact conditions (temperature, rainfall, etc.) in your area, and how these affect and govern other natural phenomena. The mysteries of the ever-changing environment become tangible, measurable entities. These processes, which influence each of us every day, can be witnessed, charted, analyzed, and discussed.

The individual weather station can also be a continuous learning center for all involved. Those who keep constant recordings of the weather can gain a knowledge of meteorological phenomena and a backlog of weather observations These data can then be used as standards for further observations and a basis for speculation and explanation of related phenomena: bird populations and nesting behavior, other animal populations, plant growth, soil quality, and other environmental factors linked to weather.

Many basic scientific concepts can be developed from operating a weather predicting station. This stems from the interest a comprehensive weather study stimulates. The kinds of parameters that you can measure at such a basic weather station are: temperature, precipitation, wind direction and speed, barometric pressure, humidity and sky cover. These data will allow you to learn about, observe, and predict weather in your local position and to under stand the role of weather in the whole of the surrounding environment.

Such a weather station was established in June, 1970 and has been in summer operation since then at Burgundy Wildlife Camp at Capon Bridge, West Virginia. This summer camp has collected figures for maximum, minimum and various daytime temperatures, humidity, barometric pressure, wind direction and velocity, precipitation and sky cover. Participants have learned to make short range predictions with consistent accuracy. Burgundy Wildlife Camp does not have TV, radio, telephone or regular delivery of newspapers, so their weather station provides not only a valuable learning experience for the campers, but also an actual service, actively supplying the residents with a relatively reliable daily forecast. The forecast, however, is not the major focus or purpose of the weather center. It demonstrates to campers the actively changing interacting sphere of weather and complements other camp programs.

Another weather station is located at George School, in Newtown, Bucks County, Pennsylvania. It has been in continuous daily operation since January 1, 1907. Alan D. Sexton, senior author-editor of this book, operated this station for six years. The station is one link in the flood warning system for the Neshaminy Creek Watershed.

George School benefits from this weather station in several ways. The superintendent of buildings uses the temperature data to compute degree days. By knowing the number degree days in any given month, he can check on the efficiency of the heating system and can identify possible problem areas in the underground steam lines. The students in the science classes use the data to construct climatograms, which they compare with those of other regions throughout the world. They also observe the results of long term data collection, a process vitally important in environmental studies, and one which many students only learn vicariously.

One function is the daily recording of high and low temperatures, precipitation, and unusual occurrences (e.g., hail, thunder, etc.). These data are sent monthly to The National Climatic Center, The Pennsylvania State Climatologist and The Neshaminy Valley Watershed Association, providing data which is used at national, state, and local levels. One of the most valuable contributions from the George School weather station is 65 years of accurate records on file. These records provide a comprehensive data bank which is available to those who wish to use it.

II. Materials and Methods

Operation of a basic weather station might utilize the following instruments:

1. A maximum-minimum thermometer which not only indicates the present temperature but shows daily highs and lows.
2. A barometer, which shows the relative air pressure, indicating pressure areas and large scale weather fronts. (Make sure the barometer is adjusted to your relative altitude so that your readings compare with official sources.)
3. A psychrometer (wet and dry bulb thermometers) or hygrometer, which shows the humidity - the relative water content of the air.
4. A wind vane, which indicates the direction of wind.
5. A wind speed indicator (anemometer), which gives wind speed.
6. A rain guage to measure precipitation in its various forms.
7. A cloud chart with pictures and symbols representing the clouds so that clouds sighted can be identified and recorded.
8. A blackboard, so that the day to day data can be recorded publicly and displayed. This information can then be transferred to a standard weather observation sheet, which can be filed for permanent record. (See Fig. 1).

The following pieces of equipment could be purchased but are of relatively little use and disproportionately high cost:

1. Rain pressure gauge which records the intensity or actual speed of the rainfall, an interesting but not absolutely necessary measurement.
2. Weather balloons, theodolite, and cloud speed apparatus (a nephoscope). These involve not only difficult procedures but offer information which is generally unimportant.
3. A solar radiation gauge, excellent for identifying sun spots but unnecessary for basic meteorology.

Two optional and expensive (approximately $60.00) yet extremely helpful and accurate pieces of equipment are a motor driven, chart recording barometer (barograph) and a similar apparatus for temperature (thermograph). These continuously record pressure and temperature in the form of line graphs.

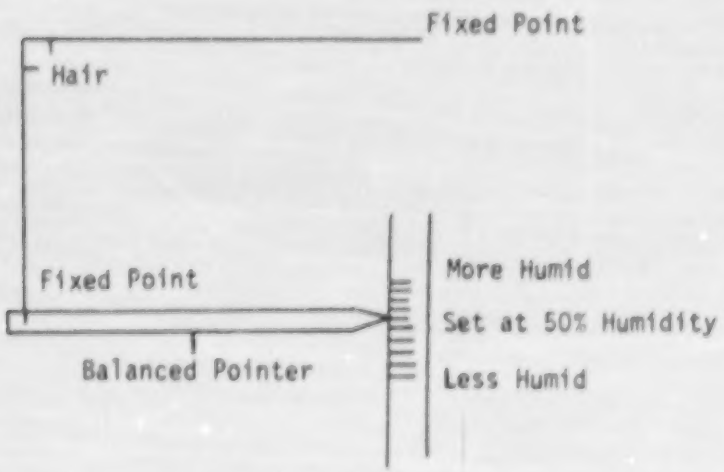
Another option that is less expensive and yet generally very valuable is daily weather maps, compiled and published by the U. S. Government for a small ($6-$7) annual fee.

Cost is an important consideration in outfitting a weather station because accuracy correlates positively with price! However, when the prime motive is not accuracy but familiarity with meteorological concepts and general trends and general acquisition of actual weather know-how, the following homemade materials are cheap and effective:

1. A wind vane can easily be devised and oriented to measure wind direction.
2. A wind speed indicator can be made in a variety of ways, including one using a ping pong ball attached to a protractor by a short piece of nylon fishing line (described in depth in the October 1971 issue

of "Scientific American").

3. A rain guage can be made from a calibrated 1" diameter glass tube which collects water falling into a 10" diameter funnel. This measures rainfall over a large area, making the gauge much easier to read for small amounts of precipitation. The number of inches of rain measured in the tube will represent ten times the actual rainfall, e.g., a reading of 1" in the gauge indicates 1/10" of precipitation.
4. A properly synchronized combination of wet and dry bulb thermometers can produce a psychrometer (humidity indicator). There are also some very temporary, makeshift materials which are not recommended for accuracy or durability, but highly useful for acquiring basic concepts.
5. A hygrometer, which also measures humidity, can be devised from a piece of hair (blond human hair is best) attached to a pointer with fingernail polish. Stretch the hair over 2 posts and attach to the end of a pointed indicator allowed to pivot across a scale calibrated against local official barometric readings.



Scale in 1/16"

6. A simple barometer can be constructed with a milk bottle. A piece of rubber balloon can be stretched across the mouth of the bottle and a paper straw glued to the balloon can be aligned with a background scale to indicate changes in air pressure.

III. Data

The data collected from the weather station at Burgundy Wildlife Camp were measured daily and recorded on mimeographed record sheets. These sheets were then placed in a permanent file to be used later in analysis. The daily data sheet for 1970 and 1971 was divided into three sections, morning, afternoon, and evening. The morning section includes appropriate titles and spaces for recording the time, minimum temperature (usually occurring the previous night), current temperature, humidity, barometric pressure, wind direction and speed, sky cover, and precipitation, with a space for prediction of future conditions. The afternoon section contains all of the above categories with the exception of minimum temperature. The evening section is also identical to the morning section, except that the minimum temperature space is replaced by a maximum temperature space. In 1972, the afternoon recording section was eliminated due to lack of recording time. Variations can easily be made on any data collection sheet to accommodate any weather station.

Each year the data was collected during each of the three sessions the camp was open, omitting the days between sessions. Students manning the weather station at the camp collected data immediately after breakfast at around 8:00 a.m., after lunch, at about 1:00 p.m., and right after dinner at 7:30 p.m. The data was displayed on a blackboard and finally entered in the file.

The minimum and maximum temperature, precipitation, and barometric pressures for the three years were graphed, using the summer term from about June 22 through July 21 as the horizontal base line and the variable as the vertical. The daily humidity was also graphed using three readings per day. In all, thirteen graphs were initially made. From this point, the data can be easily compared to any other records, local averages, or records established by the U. S. Weather Bureau Reports

The data collected daily at George School form a monthly report sent to the U. S. Department of Commerce Weather Bureau. The figures on temperature and precipitation are then entered in a monthly report for each state called Climatological Data. George School also sends its measurements of precipitation to the Neshaminy Valley Watershed Association in Doylestown, Pennsylvania. This local agency keeps on file all records of rainfall in the Neshaminy Creek Watershed. The Neshaminy Valley Watershed Association receives data from ten different locations, including George School.

Having begun measurements in 1907, George School has a lengthy list of records and is able to calculate monthly and yearly precipitation averages. Examples of data sheets from Burgundy and George School programs follow.

Weather

Burgundy Wildlife Camp

1972 Master Data Sheet

		Temperature °F		Barometric Pressure in Hg	
		Minimum	Maximum	8:00 A.M.	Precip. (in.)
June	21	--	--	---	3.20
	22	60	64	29.33	3.50
	23	52	65	29.21	2.40
	24	53	73	29.51	
	25	59	73	29.64	
	26	59	73	29.69	
	27	59	80	29.79	
	28	64	82	29.80	
	29	70	78	---	.60
	30	64	79	29.65	.10
July	1	66	80	29.69	
	2	69	92	29.87	
	6	64	72	30.05	
	7	57	75	30.11	
	8	60	78	30.08	
	9	60	80	30.08	
	10	68	88	30.08	
	11	70	90	30.14	
	12	68	82	30.12	.10
	13	72	86	29.95	.10
	14	74	88	29.88	.10
	15	71	88	29.89	
	16	72	88	29.94	.50
	17	73	88	20.02	
	18	72	88	30.08	
Average		66 Season Average	81 Season Average	29.81 Season Average	9.30 Monthly Average

Figure 3

Burgundy Wildlife Camp

DAILY MAXIMUM AND MINIMUM TEMPERATURES
1972

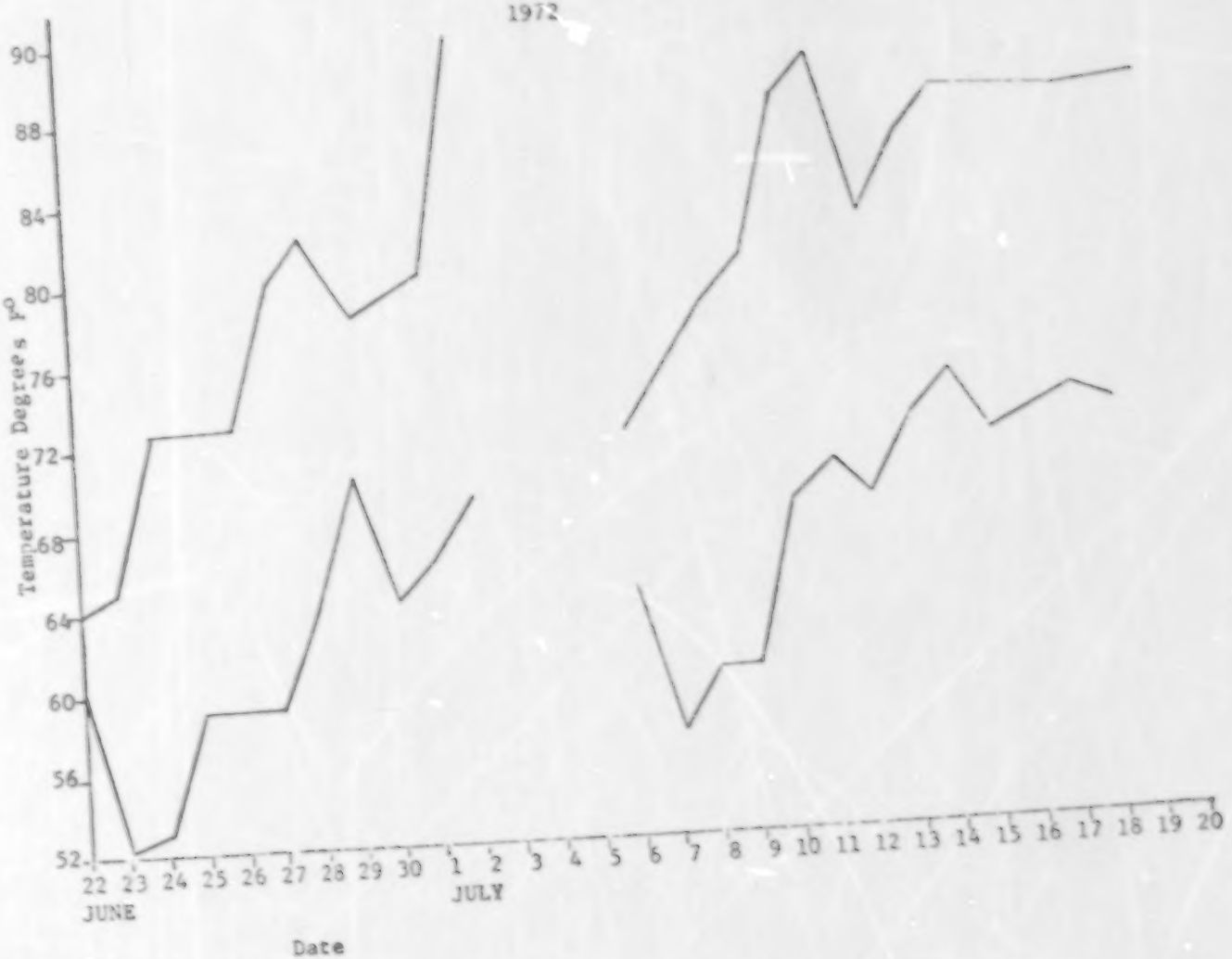


Figure 6

Burgundy Wildlife Camp

BAROMETRIC PRESSURE (Lines) AND DAILY PRECIPITATION (Bars) 1972

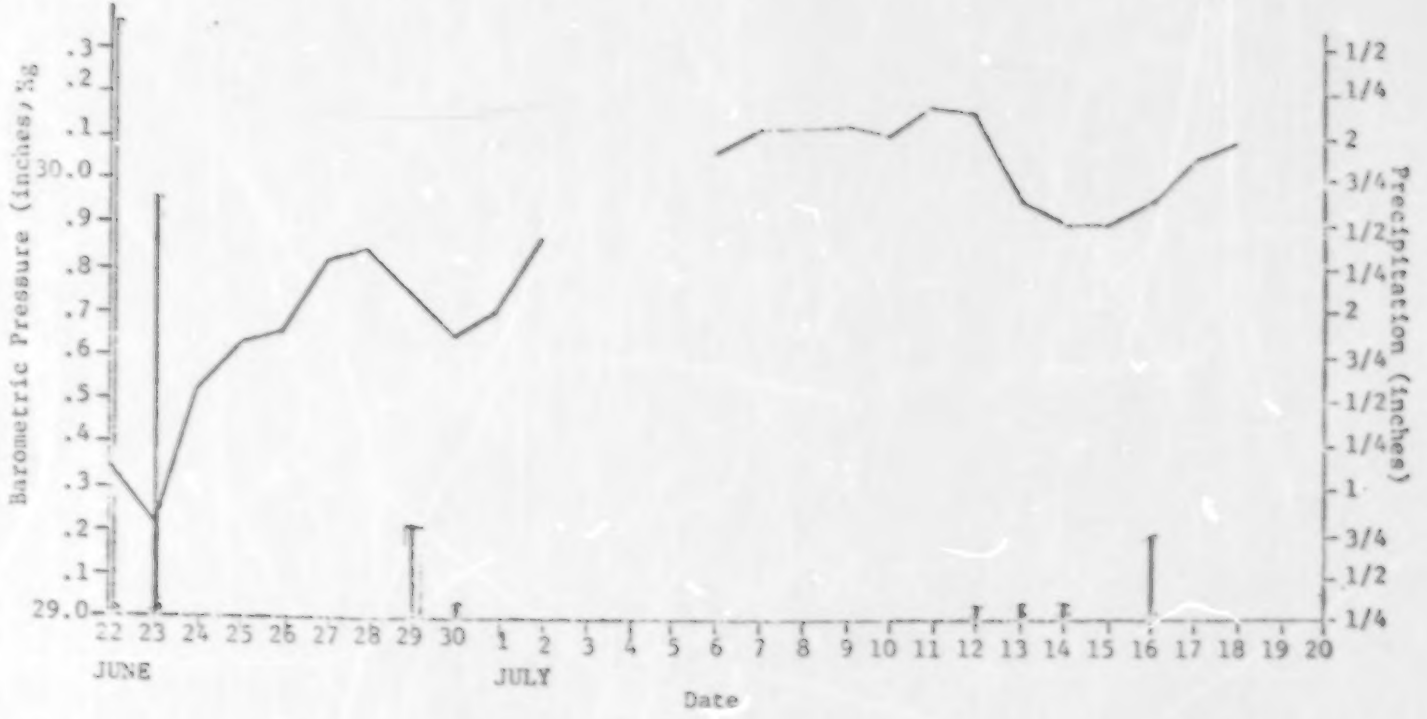


Figure 10

SUMMARY OF PRECIPITATION - NESHAMILY CREEK WATERSHED

Month DECEMBER Year 1969

Date	Station # 1	2	3	4	5	6	7	8	9	10	Ave.	Doylestown API	A	B	C	D
1				T	T	T		0.03	T	T		.44	0.03			0.03
2										T		.40	0.02			0.02
3				T								.36				
4												.32				
5												.29				
6												.26				
7												.23				
8	1.00		1.00	1.14		1.00	0.89	0.92		0.65	0.94	1.21	0.92		0.92	1.10
9	0.03			0.05		0.01	0.03	0.02		T	0.02	1.09				0.04
10												.99				
11	2.10		2.25	2.07		1.61	1.98	1.95		[illegible]	1.92	3.13	2.00		2.76	2.25
12								0.02				2.82				
13												2.54				0.08
14	0.10		0.10	0.10				0.03			0.05	2.39	0.05			0.20
15	0.20		0.20	0.05		0.23	0.24	0.16		0.20	0.19	2.35	0.22		0.24	
16												2.11				
17												1.40				
18												1.71				
19												1.54				
20												1.79				
21												1.25	0.01			
22	0.80		0.50	0.52		0.87	0.31	0.72		0.40	0.59	1.62	0.35		0.22	0.60
23	0.90		0.80	0.61		0.56	0.98			1.10	0.71	2.26	1.02		1.05	0.20
24			T	0.01		T						2.93				
25												1.93				
26	0.80		1.15	1.53		1.45	0.99	0.95		1.10	1.14	1.65	0.95		0.75	1.75
27						T		0.16			0.02	2.63	0.15			
28												2.07				
29												2.13				
30			T			0.09	0.55			0.15	0.11	1.93	0		0.32	0.85
31	0.50		0.50			0.82	0.31	0.70		0.65	0.50	3.23	0.85		0.50	
Total	6.43		6.50	6.08		6.64	6.28	5.65		5.75	6.19		6.62		15.76	7.72

Station Key

#	Name	#	Name	#	Name
1	Chalfont	6	Lansdale	A	Buckingham
2	Pipersville	7	Maple Glen	B	New Britain
3	Doylestown	8	Rushland	C	Wycombe
4	George School	9	Southampton	D	Hartsville
5	Holicong	10	Warrington		

	Amount	Station
Highest Monthly Total	7.72"	
Lowest Monthly Total	5.65"	
Greatest in 24 Hours (11th) 2.25"		Doylestown & Hartsville
Normal for month in Doylestown	3.43"	
Departure from normal in Doylestown	+3.07"	
Normal for month at George School	3.33"	
Departure from normal at George School	+2.75"	

NESHAMINY VALLEY WATERSHED ASSOCIATION
Doylestown, Pa.

Figure 3

REV:A:2

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Draft

Table — Dates on which air remperatures, recorded at George School, Bucks County, Penna., were 100°F or above, and below zero, from January 1, 1907 to February 8, 1968.

100°F or Higher

July	3, 1911	103°	July	22, 1926	100°	Sept	2, 1953	100°
July	10, 1911	100°	July	21, 1930	102°	July	22, 1955	100°
Aug.	6, 1918	100°	July	9, 1936	106°*	Aug.	2, 1955	100°
Aug.	7, 1918	105°	July	10, 1936	105°	Aug.	6, 1955	100°
June	5, 1925	100°	July	11, 1936	100°	July	21, 1957	103°
June	6, 1925	100°	July	18, 1936	100°	July	22, 1957	102°
						July	4, 1966	102°

Temperatures Below Zero

Feb.	7, 1907	-6°	Jan.	29, 1925	-6°	Jan.	18, 1954	-11°
Feb.	12, 1907	-3°	Dec.	7, 1926	-1°	Feb.	3, 1955	-6°
Feb.	13, 1907	-4°	Jan.	30, 1928	-6°	Jan.	17, 1957	-2°
Jan.	1, 1910	-2°	Dec.	19, 1932	-2°	Jan.	18, 1957	-8°
Dec.	10, 1910	-3°	Feb.	13, 1933	-5°	Jan.	19, 1957	-6°
Dec.	12, 1910	-2°	Dec.	28, 1933	-5°	Dec.	19, 1960	-1°
Dec.	17, 1910	-1°	Dec.	29, 1933	-5°	Dec.	20, 1960	-3°
Jan.	13, 1912	-8°	Dec.	30, 1933	-3°	Dec.	21, 1960	-1°
Jan.	14, 1912	-18°*	Feb.	4, 1934	-6°	Dec.	23, 1960	-4°
Feb.	10, 1912	-1°	Feb.	7, 1934	-6°	Dec.	24, 1960	-2°
Jan.	14, 1914	-5°	Feb.	9, 1934	-16°	Jan.	21, 1961	-10°
Feb.	13, 1914	-2°	Feb.	10, 1934	-4°	Jan.	22, 1961	-11°
Feb.	22, 1914	-2°	Feb.	14, 1934	-1°	Jan.	23, 1961	-9°
Feb.	25, 1914	-7°	Feb.	28, 1934	-8°	Jan.	24, 1961	-4°
Feb.	26, 1914	-6°	Jan.	25, 1935	-7°	Jan.	25, 1961	-1°
Dec.	27, 1914	-4°	Jan.	28, 1935	-14°	Jan.	26, 1961	-4°
Feb.	14, 1916	-1°	Jan.	31, 1935	-2°	Jan.	28, 1961	-13°
Feb.	15, 1916	-1°	Feb.	1, 1935	-7°	Jan.	29, 1961	-7°
Feb.	13, 1917	-2°	Feb.	7, 1935	-7°	Jan.	30, 1961	-4°
Dec.	30, 1917	-9°	Jan.	23, 1936	-5°	Jan.	31, 1961	-3°
Dec.	31, 1917	-8°	Feb.	10, 1936	-3°	Feb.	2, 1961	-8°
Jan.	1, 1918	-5°	Feb.	19, 1936	-1°	Feb.	3, 1961	-7°
Jan.	2, 1918	-3°	Feb.	20, 1936	-4°	Feb.	11, 1962	-5°
Jan.	4, 1918	-3°	Jan.	20, 1939	-2°	Feb.	12, 1962	-1°
Jan.	20, 1918	-9°	Jan.	20, 1940	-1°	Jan.	29, 1963	-4°
Jan.	21, 1918	-8°	Jan.	11, 1942	-8°	Feb.	8, 1963	-1°
Jan.	24, 1918	-2°	Dec.	21, 1942	-2°	Dec.	31, 1963	-5°
Feb.	2, 1918	-14°	Feb.	15, 1943	-1°	Jan.	1, 1964	-3°
Feb.	5, 1918	-9°	Jan.	25, 1945	-2°	Jan.	15, 1965	-6°
Feb.	6, 1918	-8°	Dec.	18, 1945	-2°	Jan.	16, 1965	-4°
Feb.	23, 1918	-1°	Jan.	29, 1948	-5°	Feb.	8, 1967	-1°
Dec.	18, 1919	-3°	Jan.	31, 1948	-5°	Feb.	9, 1967	-8°
Jan.	19, 1920	-2°	Feb.	7, 1948	-4°	Feb.	10, 1967	-6°
Feb.	1, 1920	-4°	Feb.	9, 1948	-1°	Feb.	13, 1967	-9°
Feb.	17, 1922	-2°	Dec.	27, 1948	-7°	Feb.	14, 1967	-7°
Feb.	8, 1923	-3°	Dec.	28, 1950	-3°	Jan.	2, 1968	-3°
Feb.	14, 1924	-3°	Dec.	17, 1951	-11°	Jan.	3, 1968	-3°
Jan.	28, 1925	-8°	Jan.	14, 1954	-9°	Jan.	12, 1968	-6°

* Extremes: July 9, 1936 106°
Jan. 14, 1912 -18°

Figure 4

IV. Interpretation

As soon as all information from the Burgundy weather station was graphed, overlays were made with clear vinyl plastic and felt-tip pens. By placing single overlays on each different graph, variable trends can easily be discussed. Although the Burgundy Wildlife Camp collected data for only 35 days each year, and only for three years, the relationships between barometric pressure, precipitation, temperature, and humidity were easily correlated.

Other obvious trends were:

1. A drastic drop in daily maximum temperature during periods of heavy rain.
2. The tendency for an increase in daily minimum temperature during periods of rain.
3. A general positive correlation between the maximum and minimum daily temperature.
4. A midday low average humidity.

One other phenomenon discovered by analysis of the weather graphs is the inverse relationship between barometric pressure and temperature. One can see all three years of study indicate that as the temperature reaches a high point, the barometer will register a low point and visa versa (similar to the relationship of barometric pressure to humidity).

Evidently accurate and meaningful data can be obtained from a comparatively simple weather station. The usefulness of the station is immeasurable for the acquisition of basic meteorological skills and prediction of local conditions.

The analysis of these data can always be extended to include comparisons

with U. S. Weather Bureau records and averages and further studies of the particular averages for the area. Campers at the wildlife sanctuary are also encouraged to build weather stations at their own homes.

V. Conclusions

The data collected seem to indicate that, with an analysis of meteorological trends and conditions, the weather can be predicted locally with a fairly high degree of accuracy. Once a basic knowledge of meteorology is acquired and conditions are regularly recorded over a period of time, predictions become noticeably more accurate, records more complete, and interest aroused.

We can now, from the data displayed (recorded at Burgundy Wildlife Camp), speculate on future summer weather, compare and correlate rain data with other related studies, and make day to day predictions with measurable credibility.

In order to expand their utility, these data are related to the area where they were recorded. The Burgundy Wildlife Camp has been engaged in a number of other continuous studies over the same period of time, thus creating potential fields of comparison. These other studies are of birds, trees, shrubs and flowering plants, reptiles, and insects. In each case, various weather factors can be seen as possible causes in fluctuations of population size and growth. Correlations can be made in a variety of ways, using charts, graphs and tables to map general trends and superimposing, overlapping, and comparing figures for present and selected past years. Some of these methods are illustrated in the presentation of this study (see graphs, etc.). If comparable units (e.g., time) are used, a trend analysis is made more easily with graphs.

Records of weather clearly reveal unusual conditions (flood, draught, excessive cloud cover, etc.) and can be correlated with erosion patterns, stream bed alterations, water table shifts, and pond and sewage disposal levels.

Annual individual plant and tree growth can often be measured by examining branches or tree rings. These will reflect recorded wet and dry seasons, temperatures, and resultant growth or even forest fire conditions. Bird populations (measured by banding or sighting) can be affected by weather. They are dependent on availability of food, nesting sites, predators, etc., all of which indirectly reflect weather trends as well. As conditions change, species of birds sighted will often shift accordingly. All of these changes can usually be explained or substantiated by weather records if records are complete and extensive enough.

VI. Suggestions for Further Study

A weather station can not only provide data for verification and speculation but also the impetus for further in-depth and related studies. The weather station may be expanded or re-outfitted to increase precision. This, of course, is dependent on the direction and force of interest aroused. Campers, students, club members, or families might be intrigued by the possible effects of weather on other ecological systems already cited as possible comparable areas of study.

Results of individual occurrences (storms, droughts, etc.) can be studied in terms of surrounding physical, geographical, and dendrological conditions. Local conditions and characteristics can become the subject of an individual study. Specific idiosyncracies may be studied in further depth and data collected to help observe, explain, and understand them. Any repeatedly similar readings or unusually divergent results are prime subjects for more precise and extensive investigations (e.g., and annual June flood or perhaps

a repeated August fire can be at least partially explained by weather records and conditions). Many interesting developments can be identified and clarified by examining and comparing other sources of similar data. Locating the individual weather station on a national or international weather map can help elucidate peculiar trends or inconsistent readings.

This kind of broader investigation incorporates many concepts involving geography, geology, and history, thus expanding the range of related studies. After a period of time, procedure or recordings can be adjusted to reflect new interests. The Burgundy Wildlife Camp staff eliminated their midday readings because the results were relatively insignificant. The desire may be to correlate weather analysis with specific study simultaneously underway, e.g., one might want to record the effects of solar radiation on any of the previously mentioned phenomena or on other measurements taken with the weather study.

At Burgundy Wildlife Camp temperature at the time of capture is recorded in the bird banding operations in order to study the habits of the birds more closely and increase the number of birds netted. Campers are also urged to start their own weather station at home, even if it consists of only a thermometer and barometer.

Spinoffs such as these are numerous and self-instigating. They evolve from the interest generated by the initial weather study as new factors and possibilities for data collection and use are revealed.

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